SYSTEMATIC REVIEW

Interventions for motor vehicle crashes among Indigenous communities: Strategies to inform Canadian initiatives

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ABSTRACT

OBJECTIVES: Motor vehicle crashes (MVCs) are a leading cause of death for Canadian Aboriginal peoples; developing effective interventions should be a public health priority. While intervention research has been conducted outside of Canada, few formal program evaluations have been conducted in Canada. We reviewed Canadian and non-Canadian Indigenous road safety initiatives to inform future program development in Canada.

METHODS: A systematic review of the published and grey literature examining MVC intervention programs in Indigenous communities was performed. Studies published after 1980 reporting pre-post comparisons of MVC interventions in Indigenous communities were included in the review. These studies were assessed using a modified Participatory Action Research quality assessment tool. Haddon's Matrix of injury epidemiology and prevention was used to categorize crash-related risk factors targeted in the MVC interventions.

SYNTHESIS: A total of 11 studies met inclusion criteria, including 1 Canadian study and 10 non-Canadian studies. Successful intervention components included focus groups, training community members, educational activities, distribution of safety devices, collaboration with local law officials to enhance enforcement, driver-licensing courses, and incentive programs. Potential barriers to successful implementation and evaluation involved lack of incorporation of cultural and contextual factors, enforcement factors, and methodological limitations.

CONCLUSION: Several effective strategies to reduce MVCs can be adapted and implemented at the community and national levels. Future directions might include using multiple intervention components and incorporating a collaborative, culturally and contextually appropriate approach, while promoting evaluation initiatives and widespread dissemination of findings.

KEY WORDS: Review; indigenous population; traffic accidents; accident prevention; Canada

La traduction du résumé se trouve à la fin de l'article.

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Motor vehicle crash (MVC) mortality, hospitalization and injury rates are twice as high in Aboriginal populations as in the general Canadian population.[1] MVC rates in Canada are higher for on-reserve roads than off-reserve roads[2] and for First Nations communities than rural communities (i.e., population <10,000).[3] Therefore, the development and implementation of effective intervention strategies aimed at Aboriginal communities should represent a public health priority for Canada. Although intervention evaluation research has been conducted outside of Canada (e.g., Australia, New Zealand and the United States), few studies have been conducted in Canada. The current review examines Canadian and non-Canadian initiatives targeting MVC injury in Indigenous communities in order to inform future program development in Canada. In this review, the term "Indigenous" refers to First Peoples groups within a global context. The term "Aboriginal" refers to First Nations, Inuit and Métis peoples, as recognized in the Constitution of Canada.[4] The terms "American Indian" and "Alaska Native" refer to Indigenous groups residing in the US. Last, the term "Maori" refers to the Indigenous peoples of New Zealand. Group-specific data are presented where available.

High MVC injury and mortality rates indicate a need for interventions in Canadian Aboriginal communities. In a needs assessment, Aboriginal community health representatives reported on prevention programs for unintentional injury in their regions;[5] MVCs were classified as a significant problem in 92% of the regions. Although there was an expressed need for intervention, only 33% of the regions stated that an MVC prevention program was in place, and only 13% of the regions indicated that the intervention program was "successful".[5] Although this assessment was conducted over 10 years ago, to our knowledge a more recent national assessment is not available in the literature. Given that MVC injury and mortality rates remain alarmingly high in Canadian Aboriginal communities, collaborative needs assessments are required at the national, provincial/territorial and community levels.

The development of successful interventions can be informed by Haddon's Matrix of injury epidemiology.[6,7] As expanded by Christoffel and Gallagher,[8] four sets of factors explain MVC injuries: 1) human, 2) vehicles/equipment, 3) physical environment and 4) social environment. Using this framework, Short, Mushquash and Bédard[1] reviewed epidemiological studies examining MVC injury and mortality among Canadian Aboriginal peoples. Human factors

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Table 1. Databases searched and search terms used to identify studies for review

Database	Search term
Academic Search Complete	Aboriginal
Australian Indigenous HealthInfoNet	Canada
Cochrane Library	First Nations
ERIC	Indian
Google	Indigenous
Google Scholar	Injury prevention
Health Canada – First Nations and Inuit Health	Inuit
Indigenous Studies Portal	Métis
Manitoba Aboriginal and Northern Affairs	Motor vehicle accident
MEDLINE	Motor vehicle collision
National Aboriginal Health Organization (NAHO)	Motor vehicle crash
National Indian and Inuit Community Health Representative Organization (NIICHRO)	Native
ProQuest Dissertation and Thesis Database	Road safety
PsychARTICLES	Traffic accident
PsychINFO	Transport
Public Health Department of the Cree Health Board	Unintentional injury
ScienceDirect	
Social Sciences Citation Index	
Transport Canada	
US Department of Health and Human Services – Indian Health Services	
Web of Science	

associated with increased risk were being male, being younger than 65 years old, using substances (including alcohol and prescription or illicit drugs), not wearing a seat belt, driver inattentiveness, driver inexperience, driver fatigue, careless driving, and speeding. Vehicle/equipment factors included driving in a vehicle dating back to before 1990 and specifically in a car. For physical environment factors, MVCs occurred more frequently in the territories than the provinces and on on-reserve roads compared with off-reserve roads; on-reserve MVCs were more likely than off-reserve MVCs to occur during the day and at intersections, and to involve slippery road surfaces and domestic animal interaction. Short et al.'s[1] review also revealed major research gaps, particularly in examining the social environment, such as community members' perspectives of drinking and driving, wearing seat belts or using child restraints. Haddon's Matrix might be a useful tool for MVC injury prevention in Canadian Aboriginal communities by aiding in the design of interventions to target these factors.

The purpose of the current review is to summarize published interventions for preventing and reducing MVC mortality and injuries in Indigenous communities. This review expands the current knowledge of MVC interventions by examining both Canadian and non-Canadian Indigenous road safety initiatives to inform future program development in Canada. Given the dynamic nature of Indigenous health research, which balances the priorities and desires of the community with the most appropriate research methods, Western epistemological "gold standards" (i.e., randomized controlled trials) may represent an undesirable research design for community partners, incongruent with the values and needs of a community (e.g., providing no intervention to a control community). Therefore, rather than evaluating MVC interventions in Indigenous populations solely on the basis of quality standards set forth by a Western scientific epistemology, the aim of the current review is to synthesize the effective components of all known interventions. These components can be considered by future communities and collaborators, and tailored for implementation at the community, provincial/territorial and national levels. Barriers to successful implementation and evaluation are also identified to help outline future directions for intervention research in Canada.

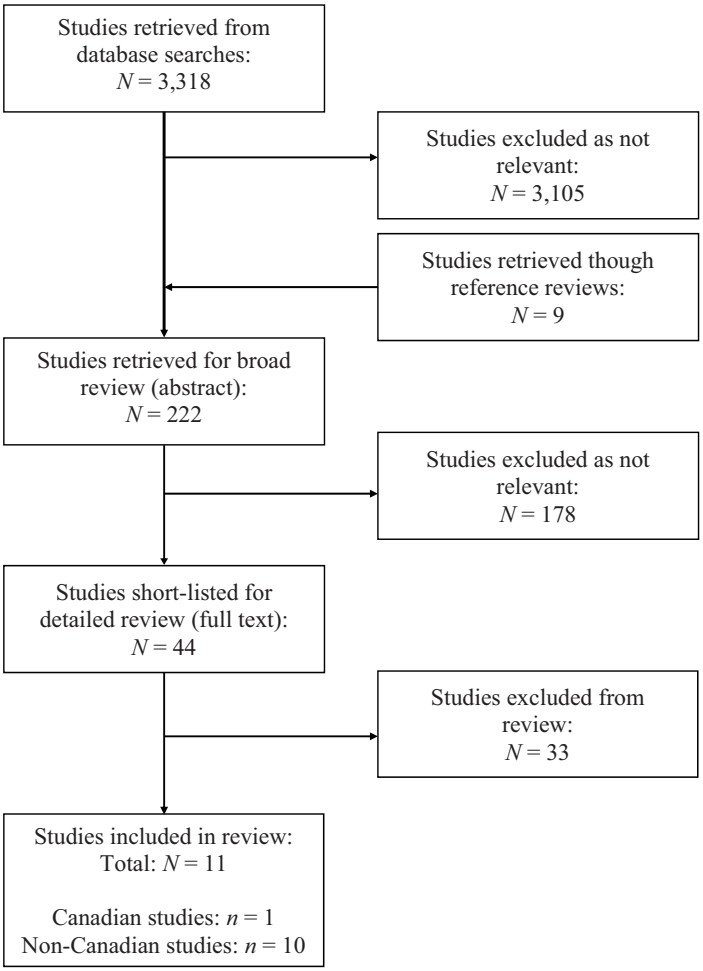

Figure 1. Flow diagram of the study search and selection process

METHOD

Data sources

A systematic search of the published peer-reviewed and grey literatures (defined as non-peer-reviewed literature, such as organizational and government reports) was conducted in accordance with approaches outlined by the Cochrane Collaboration[9] and meta-analytic methods.[10] Databases and search terms used in the current review can be found in Table 1. Reference list reviews were also conducted to retrieve any studies that may have been missed in the database searches.

Study selection

To be included in this review, studies had to be published after 1980 and had to include 1) individuals from an Indigenous community as participants in the intervention, 2) an intervention that targeted a risk factor related to MVCs, 3) pre-post intervention comparisons and 4) at least one objectively quantified outcome. Given that control communities are not always appropriate for Indigenous health research, studies were not excluded on the basis of study design or if they did not include a comparison group. The first author completed the search and coded each study as meeting or not meeting the inclusion criteria. The second and third authors were consulted if any information was unclear. Studies were first

Table 2. Criteria used to assess the quality of the studies reviewed

	Participants and the nature of their involvement
1.	Were the participants of the research appropriate to consider the needs of the project's intended users?
2.	Were provisions made to build collaboration and trust between researchers and participants?
	Shaping the purpose and scope of the research
3.	Were the research questions developed through a collaborative process between researchers and intended users?
4.	Did the research apply the knowledge and experience of intended users in conceptualizing and designing the research?
5.	Did the research consider multiple levels of determinants of health (e.g., individual, familial, organizational, political, social or economic)?
	Research implementation and context
6.	Did the research apply the knowledge and experience of intended users in the implementation of the research?
7.	Did the research provide researchers with the opportunity to learn about user perspectives on the issues being studied?
8.	Did the research provide intended users participating in the research with an opportunity to learn about research?
9.	Did the research provide intended users with the opportunity to participate in planning and executing the data collection?
	Nature of the research outcomes
10.	Did the researchers and intended users engaged in the research process have a collaborative process regarding feedback of research results to intended users?
11.	Did the researchers and intended users engaged in the research process have a collaborative process regarding the dissemination of research findings?
12.	Was there sufficient provision for assistance to intended users to indicate a high probability of research results being applied and sustained?

Note: Scoring: Yes = 2; Partially = 1; No or unable to determine = 0. Criteria adapted from Mercer et al.[14]

reviewed according to the title and abstract and then the full text. The study search and selection process is presented in Figure 1. A total of 11 studies met the inclusion criteria, 1 Canadian study and 10 non-Canadian studies. Nine studies came from peer-reviewed journals and two studies from the grey literature.

Quality assessment

The quality of any research design must be assessed through lenses that are culturally and contextually appropriate. Indigenous research designs often involve dynamic processes that utilize relational and experiential methods, such as community engagement, relationship building and narrative development.[11] It may be inappropriate to assess the quality of Indigenous research designs through established Western scientific methods. By applying rigorous systematic review standards (e.g., the Quality Assessment Tool for Quantitative Studies[12]), all of the studies identified in the search would be rated as "weak" in quality. This would represent a missed opportunity to summarize and learn from previous intervention approaches for MVC in Indigenous communities.

A recent systematic review of Indigenous research designs and Western scientific methods found no published studies that cross-validated these research paradigms.[11] There is no current evidence to dismiss Indigenous research designs on the grounds of Western notions of quality appraisal. Research is needed to develop criteria to assess Indigenous research designs, as no set standards currently exist.[11] Participatory action research (PAR) is the design most accepted by Indigenous communities, emphasizing collaborative efforts among community members, organization representatives and researchers.[13] To assess study quality, the first author coded each study using a 12-item scale that was developed by modifying existing PAR quality assessment tools.[14] The scale provides quality ratings from 0 to 24, higher ratings reflecting higher quality (see Table 2). The mean (SD) quality rating was 12.82 (5.23).

Data extraction

Data were extracted by the first author according to the following categories: population (geographic location and Indigenous community), targeted risk factors, intervention components, key findings and reported considerations. Because of the high heterogeneity of the studies (e.g., differences in study design and quantitative reporting), study results were not statistically pooled.

SYNTHESIS

Summaries of the studies are presented in Table 3.

Canadian intervention effectiveness

Only one study evaluated a Canadian intervention initiative. The intervention was implemented in three First Nation communities in Manitoba (Grand Rapids, Tootinaowaziibeeng and Sandy Bay).[15] The results indicated that child restraint use increased by 42.9% in the largest community (Grand Rapids) but only increased by 5% in the smaller community (Tootinaowaziibeeng) and by 7.8% in the control community (Sandy Bay). Pre-test and post-test observations were limited in the smaller community because of the small population and little traffic.[15] Driver restraint use, child seating position (i.e., sitting in the back seat) or riding in the back of pickup trucks did not significantly change in any of the communities. However, the authors noted that the intervention was more strongly focused on child restraint than driver restraint, which might help explain why there was greater improvement in motor vehicle safety for children.[15]

Non-Canadian intervention effectiveness

There were 10 non-Canadian intervention studies. Eight were conducted in the US, one study was conducted in Australia, and one study was conducted in New Zealand.

Six US studies involved interventions to reduce MVC injury and mortality among American Indians and Alaska Natives.[16-21] One of these studies aimed to reduce alcohol-impaired driving through enforcement.[20] The findings indicated that driving under the influence (DUI) arrests increased by 33.4%, police-reported MVCs decreased by 26.9%, nighttime MVCs decreased by 32.9%, and daytime MVCs decreased by 25.7%. Moreover, MVCs involving injuries decreased by 20.2%, and fatal MVCs decreased by 16.6%. The remaining five studies conducted with American Indians and Alaska Natives targeted restraint use and revealed that seat belt use and child safety seat use increased after the interventions.[16-19,21] John and Berger[16] and Letourneau et al.[17] incorporated follow-up evaluations into their study designs and found that although

Table 3. Intervention studies targeting motor vehicle crashes among Indigenous communities

Study	Population (geographic location and Indigenous community)	Targeted risk factors	Intervention components	Key findings	Reported considerations	Source*	Quality†
Canadian Studies							
Transport Canada[15]	Grand Rapids, Tootinaowaziibeeng, & Sandy Bay, Manitoba First Nations	*Human factors:* Correct use of car seats, booster seats, and seat belts by children and parents Children 12 years and younger riding in the rear seat Not riding in the back of pick-up trucks	Focus groups (e.g., explore local beliefs, practices, barriers and solutions, and tailor the interventions) Select community members completed child restraint technician training Brief intervention given to all three communities at baseline (e.g., correction of errors, individual counselling, and replacement of defective seats) Comprehensive intervention (e.g., education, car seat clinics) completed in two communities, and third community acted as a control group Evaluation methods included roadside and parking lot checks, and focus groups	Child restraint use increased significantly in the largest community (11.6% to 54.5%), but not in the other intervention community (40% to 45%) or the control community (18.4% to 26.2%) Driver restraint use did not significantly improve in any of the communities (34% to 26% for the full sample) No significant change in seating position or riding in the back of pickup trucks after the intervention (62% to 65% for the full sample) Predictors of correct use included driver restraint, child age (i.e., younger) and rear seating position for children	Limitations related to the timing of the intervention (i.e., middle of winter and 3-month duration) Barriers for using child restraints included (indicated in focus group): 1) cost 2) lack of awareness 3) availability (car seats not stocked in nearby stores) 4) lack of vehicle (relied on others for rides) 5) perception of low risk 6) over-capacity 7) conformity/peer pressure 8) discomfort (in children and pregnant women) 9) low enforcement 10) older vehicles (do not have anchors)	GL	19
Non-Canadian Studies							
Billie et al.[22]	Uintah and Ouray Reservation, Utah Ute Indians	*Human factors:* Correct use of child safety seats Increase seat belt use Reduce alcohol-impaired driving	Hired a full-time police officer to implement the program using a collaborative, community-based approach Community education campaign (e.g., newspaper and radio announcements, and posters) Enforcement (e.g., DUI checkpoints and saturation patrols) Child safety seat clinics	Adult restraint use increased from 22% to 42% Child restraint use increased from 20% to 42% Total MVCs reduced by 9% MVCs involving a fatality decreased by 67% MVCs involving injury decreased by 50%	Turnover in police chief position was a challenge as there was unfamiliarity with the objectives of the intervention	PR	9
Brewin & Coggan[24]	Ngati Porou Community, New Zealand Maori	*Human factors:* Reduce speeding Increase seat belt and child seat use Decrease unlicensed drivers	Focus groups with community members Road safety media campaign (e.g., radio, newspaper, factsheets, flyers, posters, t-shirts) Driver licensing course Incentive program (i.e., random checkpoints targeting seat belt use and child safety seat use with rewards, such as window stickers, balloons)	Self-reports of never exceeding the speed limit increased from 19% to 26% Child restraint use increased from 51% to 59%	Methodological challenges (e.g., geographic distance between the community and evaluation team)	PR	20

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Table 3. Intervention studies targeting motor vehicle crashes among Indigenous communities, continued

Study	Population (geographic location and Indigenous community)	Targeted risk factors	Intervention components	Key findings	Reported considerations	Source*	Quality†
John & Berger[16]	Yakama Nation,Oregon American Indians	*Human factors:* Increase infant and child safety seat use	Education component involved hands-on classroom activities at prenatal clinics Training for staff members conducting the child safety program Car seat distribution registry Evaluation methods consisted of an observational survey	Seat belt use increased from 17% to 41% Seat belt use decreased to 35% six months after campaign ended	Education efforts alone were of limited effectiveness	PR	7
Letourneau et al.[17]	Tribal Head Start Centers across United States (i.e., Arizona, Michigan, Minnesota, New Mexico, Nevada, Wisconsin) American Indians/ Alaskan Natives	*Human factors:* Increase safety seat use in children ages 3-5	Focus groups with community members and Head Start staff (to assess reasons why safety seats not used, determine marketing strategies, discuss program components) Head Start coordinators implemented program (e.g., completed child passenger safety technician training, requested child safety seats, completed follow-up home visits to review installation information and provide positive feedback) Educational activities (e.g., parent training sessions) Evaluation methods conducted by Head Start coordinators (e.g., progress reports to discuss implementation barriers, child safety seat use observational surveys)	Observations of restrained children were 74% higher after one year of implementing the program (odds ratio=1.74) Increase not sustained in following year, which may have been due to decrease in intensity of the program	Law enforcement limitations Tribal sovereignty (i.e., Tribal occupant laws differ from state laws) Difficulties with conducting observational studies	PR	19
Letourneau et al.[18]	Ho-Chunk Nation, Wisconsin American Indians/ Alaskan Natives	*Human factors:* Increase seat belt and child safety seat use	Community education events (e.g., safety expositions, crash simulations) Media awareness (e.g., billboards, radio announcements) Education and training (e.g., child passenger safety training, provision of child safety seats) Enforcement (e.g., Law Enforcement Commission participation, enhanced Click-it or ticket campaigns)	Seat belt use increased from 50.5% to 62.7% for drivers and from 32.6% to 56.0% for passengers Child safety seat use increased from 26.4% to 78.4%	No tribal police department Located in a sate with a secondary enforcement seat belt use law Membership of tribe spread across 14 counties in central and western Wisconsin	PR	12

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Table 3. Intervention studies targeting motor vehicle crashes among Indigenous communities, continued

Study	Population (geographic location and Indigenous community)	Targeted risk factors	Intervention components	Key findings	Reported considerations	Source*	Quality†
Phelan et al.[19]	Navajo Nation, Utah, Arizona, and New Mexico American Indians/ Alaskan Natives	*Human factors:* Increase seat belt and child restraint use	Enforcement (i.e., a primary enforcement safety belt use and a child restraint law)	Motor vehicle injury discharge rates (SE) significantly decreased (per 100,000): • 0-4 years: 62 (7) to 28 (4) • 5-11 years: 55.3 (6) to 26 (4) • 15-19 years: 139 (14) to 68 (7) The proportion of children aged 0-4 with new injury severity scores >4 (i.e., more severe injuries) significantly decreased	Limitations in full enforcement of restraint use laws Limitations in conducting longitudinal designs (e.g., natural trends)	PR	4
Reede et al.[20]	San Carlos Apache, Arizona American Indians/ Alaskan Natives	*Human factors:* Reduce alcohol impaired driving	Enforcement (i.e., lower the legal limit to 0.08% BAC for drivers on the reservation and increase sobriety checkpoints) Education (e.g., public information media campaign, including posters, radio, newspaper and casino announcements) Focus groups (e.g., to develop culturally appropriate media messages)	DUI arrests increased by 33.4% Police-reported MVCs decreased by 26.9% Nighttime MVCs decreased by 32.9% Daytime MVCs decreased by 25.7% MVCs involving injuries and/or fatalities decreased by 20.2% Fatal MVCs decreased by 16.6%	Shortage of police officers	PR	13
Robertson-Begay et al.[21]	Hardrock Chapter Community (Tse Dildo' ii), Arizona American Indians/ Alaskan Natives	*Human factors:* Increase seat belt and child safety seat use	Community needs assessment (e.g., designed community questionnaire and provided training of community members to conduct interviews) Distribution of car seats An incentive program (e.g., observations of safety belt use, increased police enforcement and rewards for people wearing safety belts)	Seat belt use increased from 6% to 64% Child safety seat use increased from 0% to 54%	Integration of local customs and cultural values into program activities facilitated successful implementation (e.g., public health terms needed to be translated into the Navajo language)	PR	16
Russell-Weisz[25]	East Kimberley, Western Australia Aboriginal	*Social environment factors:* Attitudes toward seat belt use, child restraint, and drinking and driving	Education (e.g., radio advertisements using local Aboriginal role models)	Self-report surveys indicated the following: • 90% of respondents could recall what the advertisement was about • 100% indicated that they thought the advertisements were appropriate for Aboriginal people • 80% indicated that they thought more about using a seat belt and not drinking and driving after hearing the advertisements	Scheduling conflicts of community meeting to measure outcomes was a challenge (i.e., low attendance)	GL	12

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Table 3. Intervention studies targeting motor vehicle crashes among Indigenous communities, continued

Study	Population (geographic location and Indigenous community)	Targeted risk factors	Intervention components	Key findings	Reported considerations	Source*	Quality†
Williams[23]	Uintah and Ouray reservation, Utah Ute Indians	*Human factors:* Increase seat belt and child safety seat use	Incentive program (e.g., seat belt checkpoint rewards for people wearing safety belts) Education (e.g., posters, radio and newspaper announcements)	Driver seat belt use increased by 111% for sedan or station wagon, 218% for a pickup truck, 17% for 4-wheel drive or van, 159% for government or tribal vehicle Passenger seat belt use increased 111% for sedan or station wagon and 225% for a pickup truck but decreased 49% for 4-wheel drive or van Infant car seat use increased by 389% for sedan or station wagon, and by 209% for 4-wheel drive or van Results maintained at 1-year follow up, with exception of regression for government and tribal vehicles	Positive relationship with the police office was an essential component to successful implementation	PR	10

* PR=published in a peer-reviewed journal; GL=published as grey literature.
† Quality score is the sum of item scores (Yes = 2; Partially = 1; No or unable to determine = 0) from the quality assessment criteria for each study (criteria listed in Table 2; adapted from Mercer et al.[14]).
DUI=driving under the influence; BAC=blood alcohol concentration.

restraint use increased during the intervention period (24% and 74% respectively), the gains were not maintained six months or one year later. It is of note that the studies of Letourneau et al.[17] and Letourneau et al.[18] included an overlapping population (i.e., Wisconsin), and while the studies report different data and time frames it is possible that they are reporting on components of the same intervention.

The additional two US studies examined MVC interventions for Ute Indians.[22,23] Billie et al.[22] employed an intervention that targeted the correct use of child safety seats, increased use of safety belts by enhanced enforcement programs and reduced alcohol-impaired driving by the use of sobriety checkpoints. Adult restraint use increased by 20%, child restraint use increased by 22%, total MVCs decreased by 9%, MVCs involving a fatality decreased by 67%, and MVCs involving injury decreased by 50%. The intervention by Williams[23] targeted seat belt use and child safety seat use. The results indicated that driver seat belt use increased by 111% for sedan or station wagons, 218% for pickup trucks, 17% for 4-wheel drive or vans, and 159% for government or tribal vehicles. Passenger seat belt use increased by 111% for sedan or station wagons and 225% for pickup trucks but decreased by 49% for 4-wheel drive or vans. Infant car seat use increased by 389% for sedan or station wagons and 209% for 4-wheel drive or vans. This study also included a follow-up, and results were maintained one year later, except for government and tribal vehicles.[23]

The study conducted in New Zealand involved an intervention that targeted reducing speeding, increasing seat belt and child car seat use, and decreasing the number of unlicensed drivers among Maori peoples of the Ngati Porou Community.[24] The findings from the intervention evaluation indicated that self-reports of never exceeding the speed limit increased by 7%, and child restraint use increased by 8% post-intervention. No follow-up was included in this evaluation.

One study was conducted in an Indigenous community of East Kimberley, Australia.[25] The intervention specifically targeted the social environment, namely attitudes towards seat belt use, child restraint, and drinking and driving. Culturally appropriate advertisements that featured local Aboriginal role models were aired over the radio, and 80% of respondents indicated that they thought more about using a seat belt and not drinking and driving after hearing the advertisements. This evaluation did not include a follow-up.

Overall, the results from intervention initiatives provide evidence of effectiveness in targeting crash-related risk factors. Participant samples tended to be small, or not reported, in many of the studies. Although sample size is a methodological concern within the Western scientific paradigm, many Indigenous communities have small populations or low vehicle traffic densities. These interventions are not meant to generalize to all Indigenous communities, and small samples suggest that the intervention was tailored to a specific community. Few studies implemented follow-up research designs, and those doing so suggested that gains might not be maintained in the long term. This finding may highlight the importance of continuing collaborations in Indigenous health research.

DISCUSSION

Targeted risk factors

The majority of MVC interventions reviewed focused on the human factors of Haddon's Matrix, with many interventions

targeting more than one human factor. Of these interventions, nine targeted proper restraint use, one targeted child seating positions, one aimed to reduce drinking and driving, one targeted speeding, and one aimed to increase the number of formally licensed drivers in the community. Although some interventions may have targeted the social environment by modifying attitudes within the community through media campaigns,[18,23] only one intervention reported outcomes of social environment change.[25]

Trends in successful intervention strategies

The current review indicates several trends in successful intervention strategies:

1) Focus groups were included in many of the interventions, particularly at the development stage.[15,17,20,21,24] A focus group is a guided discussion among community members and the research team, which provides an environment in which to complete a community needs assessment. Additionally, focus groups can be used to develop specific intervention tools. For example, Reede et al.[20] organized focus groups to develop culturally appropriate media messages. Using this approach, interventions are tailored to the needs of the community and are more likely to be effective for that group. Although focus groups were the method most commonly employed in the interventions reviewed, there are many other ways to effectively establish community engagement, such as involving community members in the delivery of the intervention.
2) Several studies provided technician training to community members, particularly for disseminating education on proper restraint use to the rest of the community.[15-17] In the intervention evaluated by Transport Canada, 13 community members completed child restraint technician training in three communities that previously had no trained individuals.[15] Community training may increase the uptake of the program, aid in developing public safety leadership within the community, and promote a collaborative environment in which capacity building can occur at an individual and community level.
3) Educational activities were included in all interventions reviewed. These included hands-on activities at after-school programs and summer youth programs;[21] public information media campaigns; use of posters, radio and newspaper announcements;[18-20,22-24] and education sessions for parents with regard to child safety seats.[17]
4) Distribution of safety devices to the community was employed in many of the interventions.[15,16,18,21] Provision and rentals of child safety seats may be an essential component in some interventions, given that high cost and low availability are barriers to using child restraints in some Indigenous communities.[15]
5) Enforcement components were incorporated into five interventions. These strategies included partnerships with local law enforcement agencies to increase the number of checkpoints that would target driving under the influence of alcohol and other substances[20-22] and more saturation patrols (i.e., many officers patrol a small geographic region where there are high rates of DUI);[22] child safety training for local officers to enhance enforcement efforts;[18] a primary enforcement seat belt use and a child restraint law;[19] and lowering the legal limit of blood alcohol concentration to 0.08% for drivers on reservations.[20]
6) A driver-licensing course was implemented in one intervention.[24] This program offered group learning sessions and one-on-one assistance to help community members attain their driver's licence. An additional advantage was that this qualification provided more employment opportunities for the participants.
7) Incentive programs were used in three of the interventions. All of the programs included random checkpoints targeting seat belt use and child safety seat use with rewards, such as t-shirts, mugs, window stickers and balloons.[21,23,24]
8) In terms of evaluations methods, observation, focus groups and self-report surveys were the most common tools employed to collect data on the effectiveness of interventions.[15-17] Moreover, some interventions trained community members to help conduct the evaluation methods.[15]

A general theme of the interventions was collaboration between the researchers and the communities. For example, holding community focus groups, training community members, and collaborating with community enforcement appeared in several successful interventions.[15,17,18,22] Context and culture were also incorporated into the evaluation methods. Brewin and Coggan[24] implemented Maori research methods, which included face-to-face interviews rather than telephone interviews, as this method fostered a balanced environment.[24] Additionally, program evaluators must be aware that Indigenous values and customs sometimes conflict with Western health education practices. Robertson-Begay et al.[21] reported that the discussion of injuries and death was not culturally appropriate in Navajo customs; thus, restraint use was encouraged in terms of "resources to answer traditional prayers for beauty, long life, and happiness" (p. 267). Clearly, implementing and evaluating interventions in a culturally appropriate and respectful manner must be a priority for program developers and evaluators.

Potential barriers to successful implementation and evaluation

A number of considerations were reported in the studies reviewed that could act as barriers to successful intervention implementation and evaluation. Interventions will not be successfully implemented if researchers do not integrate the specific cultural and contextual variables of a given community into the intervention. The timing of the intervention (e.g., during the middle of winter, for only three months)[15] and wide geographic spread of tribe members can limit the scope of the intervention activities.[18] Additionally, integrating local customs and cultural values into program activities is an important consideration (e.g., public health terms translated into the Navajo language).[21]

It is relevant to consider various enforcement factors. Tribal sovereignty should be considered and respected (e.g., tribal occupant laws differ from state/provincial laws).[17] Some authors indicated that having no tribal police department and a secondary enforcement law (i.e., an officer cannot stop a vehicle with an unbelted occupant unless some other violation is present) was a barrier to the intervention.[18] Williams[23] highlighted the fact that a positive relationship with the police department of the community

is essential. Other authors indicated barriers related to the police department, particularly when that department is deeply involved in the intervention, such as a shortage of police officers[20] and a high turnover in police chief positions.[22].

Other considerations concerned methodological factors. Authors reported difficulties with conducting observational studies.[17] A large geographic distance between the community and the evaluation team resulted in limitations to evaluating outcomes.[24] Other barriers included conflicts in scheduling community meetings, which can result in low attendance and biased results.[25] Some interventions targeted only human factors and involved only one strategy. For example, John and Berger[16] found that education efforts alone were of limited effectiveness. Few studies included a control group[15] or a follow-up to examine long-term effectiveness,[16,18,23] which can make it difficult to differentiate the effects of the intervention from natural trends.[19] However, it may not be appropriate to include a matched-control community in Indigenous research.

Future directions for Canadian intervention initiatives

This review revealed many intervention components that can be tailored and implemented in Canadian Aboriginal communities. Future interventions should consider targeting all of the factors from Haddon's Matrix (i.e., human, vehicle/equipment, physical environment, social environment) and should include outcome measures to evaluate changes in each. For example, interventions could target vehicle/equipment factors by helping to maintain vehicles (providing service checks and repairs) and the physical environment by modifying road conditions (fixing potholes). Community needs assessments can be conducted through focus groups or other methods of community engagement in order to adapt these intervention components to specific Canadian Aboriginal communities. Incentive programs are a potentially useful component in maintaining long-term gains; however, follow-up and long-term collaborative relationships with communities need to be incorporated into more intervention designs.

Collaboration emerged as an essential component to the reviewed interventions. This intervention characteristic aligns with ethical practices of public health research involving Aboriginal communities[26] and quality assessment standards. For some studies, quality assessment criteria were rated low because sufficient detail was not provided. In future research, authors might include all of the information required for quality assessments, as outlined in Table 2. This will ensure that readers can determine how studies were completed and will provide a set of standards for reporting intervention research in Indigenous communities. Although the studies included in this review may score low (e.g., "weak") on quality assessments using Western scientific methods, the findings represent current Indigenous MVC intervention strategies and the research methods needed to build collaboration between community members and researchers.

Only one study examined a Canadian intervention, suggesting limited evaluation and dissemination of interventions in Canada. A limitation of this review is that interventions that were not disseminated may be absent. Widespread dissemination will help reach community-based groups, researchers, government decision-makers, and program developers and evaluators.

CONCLUSION

The current review examined Canadian and non-Canadian Indigenous road safety initiatives in order to inform future program development in Canada. This review revealed several intervention components that can be tailored for implementation at the national and community levels, including focus groups, training of community members, educational activities, distribution of safety devices, collaboration with local law officials to promote enforcement, a driver-licensing course, incentive programs, and various evaluation methods. Potential barriers to successful implementation and evaluation were failure to incorporate cultural and contextual factors, law enforcement factors, and methodological limitations. Future directions for Canadian initiatives might include multiple intervention components to target the factors of Haddon's Matrix, a collaborative, culturally and contextually appropriate approach, and widespread dissemination of findings to promote uptake by other communities.

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RÉSUMÉ

OBJECTIFS : Les accidents d'automobile sont l'une des principales causes de mortalité pour les Autochtones du Canada; élaborer des interventions efficaces devrait donc être une priorité pour la santé publique. On effectue de la recherche d'intervention hors du Canada, mais on mène peu d'évaluations formelles des programmes canadiens. Nous avons examiné des initiatives canadiennes et non canadiennes de sécurité routière indigène afin d'éclairer l'élaboration future de programmes au Canada.

MÉTHODE : Nous avons mené une revue systématique de la littérature publiée et de la littérature grise portant sur les programmes de prévention des accidents d'automobile dans les communautés indigènes. Nous avons inclus dans cette revue les études publiées après 1980 établissant des comparaisons pré/post des interventions portant sur les accidents d'automobile dans les communautés indigènes. Ces études ont été évaluées à l'aide d'un outil modifié d'évaluation de la qualité de la recherche-action. La matrice de Haddon appliquée à l'épidémiologie et à la prévention des blessures a servi à catégoriser les facteurs de risque d'accident ciblés par les interventions portant sur les accidents d'automobile.

SYNTHÈSE : En tout, 11 études ont répondu à nos critères d'inclusion, dont une étude canadienne et 10 études non canadiennes. Les éléments des interventions fructueuses étaient les groupes de discussion, la formation des membres de la communauté, les activités éducatives, la distribution de dispositifs de sécurité, la collaboration avec les agents locaux de la force publique pour améliorer l'application de la loi, les cours d'obtention du permis de conduire et les programmes d'incitation. Les obstacles possibles à la mise en œuvre fructueuse et à l'évaluation étaient le manque d'intégration des facteurs culturels et contextuels, les facteurs d'application de la loi et les contraintes méthodologiques.

CONCLUSION : Plusieurs stratégies de réduction des accidents d'automobile efficaces peuvent être adaptées et mises en œuvre à l'échelle communautaire et nationale. Les orientations futures peuvent inclure l'utilisation d'outils d'intervention multiples et l'intégration d'une approche concertée, appropriée sur les plans culturel et contextuel, tout en favorisant les initiatives d'évaluation et la diffusion généralisée des constatations.

MOTS CLÉS : revue de la littérature; population d'origine amérindienne; accidents de la circulation; prévention des accidents; Canada