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Relevancy and Feasibility Of Firefighting Solutions In Newfoundland and Labrador, Canada

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Relevancy and Feasibility of Firefighting Solutions In Newfoundland and Labrador, Canada

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Abstract

Volunteers represent a large portion of firefighters in Canada and in Newfoundland and Labrador. Many of these firefighters live and work in rural communities, presenting a range of challenges in providing service. These challenges, and a number of potential solutions, have been documented in the literature originating from both Canada and around the world. This case study examined the perceptions of the relevancy and feasibility of 38 solutions, previously identified in the literature, for the fire service in Newfoundland and Labrador, Canada. Some perceptions, such as the relevancy and feasibility of online, mobile, and flexible training, were in line with the reviewed literature, while others, such as the relevancy and feasibility of cold-weather training, were less aligned. Some solutions were reported as having been implemented in at least one participant's department, while others were not reported as being implemented at all. These findings can inform future discussions with firefighters, researchers and other community stakeholders, leading to the appropriate focus of further research.

Keywords: firefighting, rural, relevancy, feasibility, resources, training, planning, community

Pertinence et faisabilité des solutions de lutte contre les incendies à Terre-Neuve-et-Labrador, au Canada

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Résumé

Les bénévoles représentent une part importante des pompiers au Canada et à Terre-Neuve-et-Labrador. Nombre d'entre eux vivent et travaillent en milieu rural, ce qui pose divers défis pour la prestation des services. Ces défis, ainsi que plusieurs solutions potentielles, ont été documentés dans la littérature canadienne et internationale. Cette étude de cas a examiné les perceptions quant à la pertinence et à la faisabilité de 38 solutions, déjà identifiées dans la littérature, pour les services d'incendie de Terre-Neuve-et-Labrador, au Canada. Certaines perceptions, comme la pertinence et la faisabilité des formations en ligne, mobiles et flexibles, concordaient avec la littérature examinée, tandis que d'autres, comme la pertinence et la faisabilité de la formation par temps froid, l'étaient moins. Certaines solutions ont été signalées comme ayant été mises en œuvre dans au moins un service participant, tandis que d'autres n'ont pas été mises en œuvre du tout. Ces résultats peuvent éclairer de futures discussions avec les pompiers, les chercheurs et d'autres intervenants communautaires, et ainsi orienter les recherches futures.

Mots-clés : lutte contre les incendies, rural, pertinence, faisabilité, ressources, formation, planification, communauté

1.0 Introduction and Background

Providing fire services in rural communities presents several documented challenges (Pardy & Sanli, 2022). For example, there are often limited financial, capital, and human resources (Colibaba et al., 2021; Fang et al., 2018; Wainwright & Dhaliwal, 2013). The scope of firefighter training and job responsibilities has expanded in recent years, and social and other changes in rural communities, along with environmental characteristics, further contribute to difficulties in providing service (Stalker & Phyne, 2014).

In 2016, the National Fire Protection Association estimated that 83% (126,650 of 152,650) of firefighters in Canada were volunteer firefighters. Most of these volunteers were in departments that were responsible for populations of 50,000 or fewer (Haynes & Stein, 2018). By 2023, this proportion had declined to 71%, reflecting a reduction of nearly 38,000 volunteer firefighters as estimated by the Canadian Association of Fire Chiefs census data (88,586 of 125,628). This census data also estimated a total of 9,485 volunteer firefighters had retired within the last year, representing a total of 102,219 years of service, with an additional 30% of current firefighters being over the age of 50. Additionally, 54% of fire departments in Canada deferred purchases, and 23% deferred training in 2023, while only 15% of fire department expenditures were attributed to volunteer fire departments, that same year (Canadian Association of Fire Chiefs, 2023).

Most municipal fire departments in Newfoundland and Labrador are volunteer-based, making volunteer firefighters the majority of fire service personnel in the province (Fire and Emergency Services Newfoundland and Labrador [FES-NL], 2015). In 2015, 77% of fire departments within the province were serving populations under 1,000 people (FES-NL, 2015). As of 2015, the most recent year of publicly available information, most firefighters in the province were over the age of 36 years, with few younger firefighters coming forward to volunteer. The median age of the Newfoundland and Labrador population, as of the 2021 census, is 48.4 years, the highest in the country, suggesting that this trend will continue (Statistics Canada, 2025). These volunteer fire departments are owned and operated by municipalities, Inuit Community Governments, local service districts or regional service boards (FES-NL, 2015). Several fire departments serve more than one community through service agreements.

A 2022 scoping review of academic and grey literature identified challenges and solutions related to fire service delivery in rural and cold climate communities worldwide (Pardy & Sanli, 2022). This review was conducted because the scope and types of information available pertaining specifically to rural, cold-climate firefighting were unclear. Additionally, the authors sought to better understand this complex topic and allow for the refining of future research questions (Pardy & Sanli, 2022; Levac et al., 2010). Solutions were identified in the areas of resources, including recruitment and retention of firefighters (e.g., in relation to Canadian wildfire strategy: Hirsch & Fuglem, 2006), changes to administration and governance structures (e.g., regionalization in Newfoundland and Labrador: Curran, 2018), financial investments in capital projects, programming, and planning (e.g., replacing aging Canadian equipment: Hirsch & Fuglem, 2006), as well as use of internet-based resources (e.g., an online fire reporting system: Fang et al., 2018). Some solutions were specific to planning strategies (e.g., better understanding communities at risk: Clare & Kelley, 2017) and training strategies (e.g., standardization of training requirements: Wainwright & Dhaliwal, 2013), while

others focused on community through increased collaboration (e.g., across organizations: Tymstra et al., 2020) and education initiatives (e.g., for at-risk communities and households: Clare & Kelley, 2017). Pardy and Sanli's (2022) review documented the information sources available but did not provide an assessment of the relevance and feasibility of the collected solutions to Newfoundland and Labrador. The authors did recommend this assessment for further research (Pardy & Sanli, 2022).

Additional recent research has specifically examined important issues in volunteer fire services in Canada. In line with the data presented by FES-NL (2015), Colibaba et al. (2021) describe an aging volunteer firefighter demographic globally and nationally, along with results of a case study of a rural volunteer fire department in Ontario, Canada. Through interviews, they drew out themes of aging, intergenerationality, and interconnectedness between volunteers and the community in the volunteer fire service context. Blaney and colleagues (2021) conducted a qualitative study within a representative fire rescue service and distilled six interrelated concepts that construct resilience in volunteer firefighters: relationships, personal resources, meaning-making, leadership, culture, and knowledge. Henderson et al. (2023) used survey data from volunteer firefighters to better understand how they view their group experiences. They highlighted the importance of connections between leaders and subordinates, focusing on the mission of the organization, feelings that work is making a difference, and extensive group training to feelings of group belonging. Cramm et al. (2021), also using survey data, described an association between mental health and sleep for both career and volunteer firefighters and suggested that sleep be considered in health programming and monitoring. Nazari et al. (2020) used a survey to examine the exposure of firefighters to critical events across their careers, revealing that age, gender, and years of service could explain one-third of the variance in the number of exposures (experienced by almost all respondents) across firefighters. Pennington et al. (2022) revealed differences in access to behavioural health resources between career and volunteer firefighters, where volunteers were more likely to report cost as a barrier, and both reported stigma as a common barrier. Cherry and colleagues (2021; 2023) examined particulate and other harmful exposures of firefighters in specific contexts and recommended that rapid research be deployed after major events. Gouliquer et al., 2020 conducted a Canada-wide study to better understand the experiences of volunteer and career women firefighters and provide recommendations to transform cultural environment, practices, and policies to be more inclusive.

The present case study sought to elicit firefighter perceptions regarding the relevance and feasibility of several identified solutions, specific to rural and cold-climate contexts for the volunteer fire service in Newfoundland and Labrador, Canada.

2.0 Methods

An online survey was developed to solicit opinions of volunteer firefighters on the relevance of cold-climate, rural firefighting solutions for Newfoundland and Labrador.

2.1 Survey Development

A recent scoping review (Pardy & Sanli, 2022) identified 14 broadly defined, global challenges in cold-climate, rural firefighting. These challenges were categorized into four areas: resources, environment, firefighting tasks, and community. The review

identified 95 separate solutions for these challenges across the four categories. Scoping reviews are conducted to map and summarize the information that is available about a specific topic and to identify gaps in knowledge (Tricco et al., 2018). Pardy and Sanli (2022) documented possible solutions (published in English) from 13 countries throughout the world. Colibaba and colleagues (2021) explain that firefighting experiences can be different based on the geographical areas in which they take place. With this in mind, the authors of the present study sought to determine which of the solutions gathered by Pardy and Sanli (2022) would be perceived as most relevant and feasible in the context of Newfoundland and Labrador.

In order to efficiently use the time of volunteer participants, three subject matter experts with collective expertise in rural and urban, as well as volunteer and career firefighting, first assessed the relevance of these solutions to Newfoundland and Labrador with the purpose of identifying a more manageable number of questions for the final survey. To accomplish this, each subject matter expert scored all 95 solutions reported by Pardy and Sanli (2022) on a five-point scale from extremely relevant (1) to extremely irrelevant (5) for a Newfoundland and Labrador context, using an online survey platform. The ratings from all subject matter experts were summed for each solution. Solutions with a summed score of 5 or less were considered to have relevant agreement, while those with a summed score of 13 or higher were considered to have irrelevant agreement. Summed scores between 6 and 12 were indicative of a lack of agreement, or the solution was scored as not relevant enough. Only solutions considered to have relevant agreement were included in the final survey for distribution. In total, 38 solutions met the criteria for inclusion in the final survey.

2.2 Procedure

An online survey, approved by the institutional Interdisciplinary Committee on Ethics in Human Research, asked volunteer firefighters in Newfoundland and Labrador to comment on the feasibility and relevance of each of 38 specific solutions. Each solution was rated for relevance and feasibility using a scale from 0 (low relevancy) to 100 (high relevancy) and 0 (low feasibility) to 100 (high feasibility). Additionally, a check box was provided to indicate if a solution was already implemented in their department. Volunteer firefighters were invited to complete the survey through an email sent to members by the provincial association of fire services. The invitation was also shared with members through the association's social media accounts.

3.0 Results

Data are presented for six complete responses representing volunteer firefighters from Avalon, Central, and Eastern regions of Newfoundland and Labrador. Seven additional participants completed less than half of the survey questions, and their data were excluded. Both urban and rural areas were represented, with a greater emphasis on rural area participants. A range of job titles within the fire service were represented. Half of the participants had served in their current roles for five or fewer years, while half had served in their current roles for 10 or more years. All participants had over 10 years of experience in the fire service.

3.1 Relevancy of Proposed Solutions

Mean relevancy scores ranged from 37.5 to 100, with 17% of the solutions receiving mean relevancy scores of 90 or above, 42% receiving a mean relevancy score of 80 or above and 78% 70 or above. In general, the higher the mean relevancy score, the less variability (standard deviation) between scores was recorded ($r=-.67$, $p<.001$). Table 1 lists all presented solutions in order of mean relevancy score.

Table 1. *Mean Relevancy Scores and Standard Deviations for Each Presented Solution*

Presented Solution	Mean	Standard Deviation
Resources		
Set targets and expectations for training providers.	100.0	0.0
Have well-trained personnel for all components of fire service.	94.8	11.1
Implement standards for grants, emergency preparedness plans, building materials, residential structures, and rural fire departments.	90.5	7.9
Invest in modern equipment.	83.7	18.4
Provide rewards, recognition, challenge, autonomy, leadership, support, intrinsic and extrinsic motivators to firefighters.	82.0	28.0
Have separate rural and urban requirements.	81.0	21.3
Invest in smoke alarms and residential sprinklers.	80.8	38.0
Promote a good image to the public and positive member relationships.	76.0	22.9
Have an interactive map of all available water sources.	74.0	21.9
Regionalization/share expenses between departments.	73.5	49.1
Provide long-term funding for FireSmart communities.	73.0	36.6
Invest in firehouses.	68.6	43.8
Public GIS database of areas of risk.	47.0	27.1
Firefighting tasks (training)		
Increase oversight and enforcement of minimum training.	93.6	14.3
Incorporate technologies through fire schools.	84.2	20.3
Increase capacity and opportunities for quality training.	83.2	26.5
Leadership development for Fire Chiefs and officers.	82.8	23.2
Have physical/virtual simulations for firefighting and command and control for cold climate, use real cases training to identify and monitor risk parameters for natural water supply issues, weather measurement and prediction.	79.4	24.9
Specialized training office within rescue regions.	78.7	25.1
Manage time demands through online, flexible, and mobile training.	74.8	37.6

Table 1 continued

Optimize operations through training with mutual aid departments.	74.0	22.7
Evaluate entry training requirements and timelines.	67.8	28.2
Conduct cold-weather outdoor training, including cold injury awareness and apparatus and SCBA training/familiarization.	65.5	32.7
Firefighting Tasks (planning)		
Planned water supply network, including what-if analysis of new sources; document static water sources.	93.6	11.7
Maintenance of pump, apparatus, valves, hoses, fuel tank, caps, plugs, SCBA for cold weather; performance-based winterization.	84.0	15.3
Have proactive planning and design policies and practices; process approach.	72.6	21.8
Label primary streets used for response and contact snow removal agency with it.	70.0	38.4
Adopt hazard identification and risk reduction strategies from other industries or use Homesafe methodology.	69.8	37.5
Have extra personnel and equipment, especially at rural stations when risk is high due to weather.	66.8	15.6
Standardize fill connections across mutual aid group.	63.0	41.3
Standardize operating procedures and methods for performance measurement, including for winter operations.	62.7	40.6
Consider seasonal accessibility for apparatus and personnel.	37.5	43.5
Community		
Work with school children and families to keep hydrants clear and marked in the snow.	91.0	10.9
Targeted smoke alarm giveaway for high-risk communities.	83.0	30.3
Home visit program/proactive partner-based prevention for elderly.	77.3	39.3
Increased support and targeted education for children.	76.8	35.7
Public and corporate education on fire behaviour and prevention.	73.6	37.7
Programs for proper smoke alarm use and maintenance.	66.6	35.3

3.2 Feasibility of Proposed Solutions

Mean feasibility scores ranged from 28.8 to 89.3, with 0% of the solutions receiving mean feasibility scores of 90 or above, 17% receiving a mean feasibility score of 80 or above, and 33% receiving a 70 or above. In general, the higher the mean relevancy score, the less variability (standard deviation) between scores was recorded ($r=-.40$, $p=.01$). Table 2 lists all presented solutions in order of mean feasibility score.

Table 2. *Mean Feasibility Scores and Standard Deviations for Each Presented Solution*

Presented Solution	Mean	Standard Deviation
Resources		
Set targets and expectations for training providers.	89.3	7.4
Have well-trained personnel for all components of fire service.	71.0	19.8
Invest in smoke alarms and residential sprinklers.	69.5	37.9
Implement standards for grants, emergency preparedness plans, building materials, residential structures, and rural fire departments.	67.2	33.7
Invest in modern equipment.	66.2	25.8
Promote a good image to the public and positive member relationships.	65.2	24.0
Provide long-term funding for FireSmart communities.	64.3	35.1
Have separate rural and urban requirements.	61.6	22.0
Provide rewards, recognition, challenge, autonomy, leadership, support, intrinsic and extrinsic motivators to firefighters.	60.5	38.3
Regionalization/share expenses between departments.	59.4	39.6
Invest in firehouses.	53.8	43.0
Public GIS database of areas of risk.	31.3	28.6
Have an interactive map of all available water sources.	28.8	15.2
Firefighting tasks (training)		
Manage time demands through online, flexible, and mobile training.	84.4	7.1
Increase oversight and enforcement of minimum training.	83.4	12.7
Incorporate technologies through fire schools.	79.6	17.5
Evaluate entry training requirements and timelines.	68.3	35.0
Leadership development for Fire Chiefs and officers.	66.3	41.0
Increase capacity and opportunities for quality training.	61.0	28.2
Have physical/virtual simulations for firefighting and command and control for cold climate, use real cases training to identify and monitor risk parameters for natural water supply issues, weather measurement and prediction.	56.8	28.5
Optimize operations through training with mutual aid departments.	55.4	29.7
Specialized training office within rescue regions.	40.0	19.1
Conduct cold-weather outdoor training, including cold injury awareness and apparatus and SCBA training/familiarization.	39.5	23.2

Table 2 continued

Firefighting Tasks (planning)

Standardize fill connections across mutual aid group.	88.5	15.6
Label primary streets used for response and contact snow removal agency with it.	85.5	10.8
Planned water supply network, including what-if analysis of new sources; document static water sources.	76.0	18.4
Maintenance of pump, apparatus, valves, hoses, fuel tank, caps, plugs, SCBA for cold weather; performance-based winterization.	76.0	3.8
Have extra personnel and equipment, especially at rural stations when risk is high due to weather.	59.8	14.2
Standardize operating procedures and methods for performance measurement, including for winter operations.	54.7	35.3
Have proactive planning and design policies and practices; process approach.	52.4	27.6
Adopt hazard identification and risk reduction strategies from other industries or use Homesafe methodology.	46.8	35.0
Consider seasonal accessibility for apparatus and personnel.	37.3	43.6

Community

Work with school children and families to keep hydrants clear and marked in the snow.	87.8	2.6
Home visit program/proactive partner-based prevention for the elderly.	78.6	42.5
Increased support and targeted education for children.	71.6	35.4
Targeted smoke alarm giveaway for high-risk communities.	66.8	45.8
Public and corporate education on fire behaviour and prevention.	58.0	29.0
Programs for proper smoke alarm use and maintenance.	56.2	32.5

3.3 Current Implementation of Presented Solutions

For 72% of the presented solutions, at least one participant indicated that it was already implemented in their department. Table 3 indicates the percentage of participants for each solution, indicating current use in their department.

Table 3. *Current Implementation of Presented Solutions Organized by the Percentage of Participants who Indicated a Given Solution was Already Implemented in their Department*

Implemented by 50% of participants' departments
<ul style="list-style-type: none">-Set targets and expectations for training providers.-Label primary streets used for response and contact snow removal agency with it.-Have well-trained personnel for all components of fire service.-Promote a good image to the public and positive member relationships.-Provide rewards, recognition, challenge, autonomy, leadership, support, intrinsic and extrinsic motivators to firefighters.-Have extra personnel and equipment, especially at rural stations when risk is high due to weather.
Implemented by 33% of participants' departments
<ul style="list-style-type: none">- Standardize fill connections across mutual aid group.- Increase oversight and enforcement of minimum training.- Incorporate technologies through fire schools.- Maintenance of pump, apparatus, valves, hoses, fuel tank, caps, plugs, SCBA for cold weather; performance-based winterization.- Planned water supply network including what-if analysis of new sources; document static water sources.- Leadership development for Fire Chiefs and officers.- Have physical/virtual simulations for firefighting and command and control for cold climate, use real cases training to identify and monitor risk parameters for natural water supply issues, weather measurement and prediction.- Optimize operations through training with mutual aid departments.- Standardize operating procedures and methods for performance measurement, including for winter operations.- Specialized training office within rescue regions.- Conduct cold-weather outdoor training, including cold injury awareness and apparatus and SCBA training/familiarization.- Have an interactive map of all available water sources.
Implemented by 17% of participants' departments
<ul style="list-style-type: none">- Work with school children and families to keep hydrants clear and marked in the snow.- Manage time demands through online, flexible, and mobile training.- Increased support and targeted education for children.- Evaluate entry training requirements and timelines.- Targeted smoke alarm giveaway for high-risk communities.- Invest in modern equipment.

Table 3 continued

- Increase capacity and opportunities for quality training.
 - Public and corporate education on fire behaviour and prevention.
 - Programs for proper smoke alarm use and maintenance.
 - Have proactive planning and design policies and practices; process approach.
 - Consider seasonal accessibility for apparatus and personnel.
-

Implemented by 0 of participants' departments

- Home visit program/proactive partner-based prevention for the elderly.
 - Invest in smoke alarms and residential sprinklers.
 - Implement standards for grants, emergency preparedness plans, building materials, residential structures, and rural fire departments.
 - Provide long-term funding for FireSmart communities.
 - Have separate rural and urban requirements.
 - Regionalization/share expenses between departments.
 - Invest in firehouses.
 - Adopt hazard identification and risk reduction strategies from other industries or use Homesafe methodology.
 - Public GIS database of areas of risk.
-

4.0 Discussion

This case study captured perceptions of a small group of volunteer firefighters in Newfoundland and Labrador regarding the relevance and feasibility of a range of solutions for challenges in rural, cold-climate fire service. Several of the proposed solutions that were rated highly in terms of relevancy for Newfoundland and Labrador were also rated highly for feasibility.

Training-related solutions, such as setting targets and expectations for training providers, increasing oversight and enforcement of minimum training, and incorporating technologies through fire schools, were all considered highly relevant and feasible. Perhaps this is not surprising, given that FES-NL (2015) reported a lack of training for both defensive exterior fire suppression and interior fire suppression and rescue amongst assessed volunteer fire departments. This includes initial theory and practical skills instruction as well as ongoing training. FES-NL (2015) reported that only 46% of departments maintained an active training program. Systematic record-keeping of members' training was also flagged for improvement.

All three of these solutions were indicated as currently implemented in their department by at least one-third of participants. Discussion of each of these solutions, rated as highly relevant and feasible, can be found in a Canadian report that assessed fire training needs in British Columbia (Wainwright & Dhaliwal, 2013). This report also had a strong focus on rural considerations and indicated many similar challenges to those reported for Newfoundland and Labrador (Fang et al., 2018; Pardy & Sanli, 2022). Incorporating technologies through fire schools,

especially for rural departments, was also discussed and advocated for by Hamins and colleagues in their guide to prioritizing research (2012).

Conversely, cold-weather outdoor training was rated relatively low for both relevance and feasibility, despite one-third of participants indicating that it was currently implemented in their department. Metallinou & Log (2017) discussed training of winter month scenarios as a way to illustrate differences in fire behaviours and associated outcomes to students.

While participants showed consistency in rating the feasibility of managing time demands through online, flexible, and mobile training, there was much more variability (indicated by the high SD) in the rating of its relevancy. This variability seems in line with O'Neal (2017), who reported that online training is viewed both as a way to manage time demands and as less effective than hands-on training. Catino (2015) presented online, flexible, and mobile training options, citing the National Volunteer Fire Council (NVFC, 2010) as a possible solution to ever-increasing training time demands for volunteers. NVFC (2010) also discussed the need for buy-in from leadership in volunteer departments for these types of training, which requires the time and financial resources to do so reasonably. Cote et al. (2014) discussed diversifying training formats to overcome training time challenges, while Hamins et al. (2012) discussed web-based training as a way to transfer science-based technology and information to the fire service community.

Planning solutions that were rated highly for relevancy included a planned water supply network, implementing various standards, and equipment maintenance and winterization for cold weather. These were also among the highest-rated planning solutions for feasibility. While implementing the specific standards were not indicated as currently implemented by any participants' departments (and would not originate from a departmental level), the other two solutions were indicated as currently implemented by 33% of participants' departments. Other planning solutions with relatively high feasibility scoring included standardizing fill connections, labelling primary streets for response and informing snow removal agencies of this information. These have already been implemented by 33% and 50% of participants' departments, respectively.

A community-focused solution that was rated as highly relevant and feasible was working with school children and families to keep hydrants clear and marked in the snow. Community-focused solutions that were rated as relatively high in feasibility included a home visit program or proactive partner-based prevention for the elderly (Clare & Kelly, 2017) and increased support and targeted education for children, though these options were not rated as highly for relevancy. Investing in modern equipment was rated as the most relevant solution directly involving financial investment, while investing in smoke alarms and residential sprinklers was rated as more feasible.

There are some limitations of this study that should be acknowledged. Despite invitations to participate being sent to the population of volunteer firefighters in Newfoundland and Labrador, the sample size is small and cannot be considered an adequate representation of the approximately 6000 firefighters within the province. Previous research with small sample sizes has, however, furthered our understanding of volunteer fire fighting (e.g., Blaney et al., 2021) While the survey link was sent for individuals to complete at a time and place convenient to them, we can not discount the possibility of participants answering in a socially desirable way (Price & Murnan, 2004).

5.0 Conclusions

The study provides novel insights into how a large selection of solutions to rural, cold-climate fire service challenges are perceived in terms of relevance and feasibility in Newfoundland and Labrador. To our knowledge, this is the first study to link findings from a scoping review of firefighting challenges and solutions to perceptions of firefighters in a specific Canadian province. While some perceptions were in line with the reviewed literature, such as those for online, mobile, and flexible training, others, such as cold weather training, were less aligned. These findings can inform the foci of future research projects and opportunities for knowledge translation activities.

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