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## Original article

## Tailored Sun Safety Messages for Outdoor Workers

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## ABSTRACT

**Background:** Messaging surrounding skin cancer prevention has previously focused on the general public and emphasized how or when activities should be undertaken to reduce solar ultraviolet radiation (UVR) exposure. Generic messages may not be applicable to all settings, and should be tailored to protect unique and/or highly susceptible subpopulations, such as outdoor workers. The primary objective of this study was to develop a set of tailored, practical, harm-reducing sun safety messages that will better support outdoor workers and their employers in reducing the risk of solar UVR exposure and UVR-related occupational illnesses.

**Methods:** We adapted a core set of sun safety messages previously developed for the general population to be more applicable and actionable by outdoor workers and their employers. This study used an integrated knowledge translation approach and a modified Delphi method (which uses a survey-based consensus process) to tailor the established set of sun safety messages for use for outdoor worker populations.

**Results:** The tailored messages were created with a consideration for what is feasible for outdoor workers, and provide users with key facts, recommendations, and tips related to preventing skin cancer, eye damage, and heat stress, specifically when working outdoors.

**Conclusion:** The resulting tailored messages are a set of evidence-based, expert- approved, and stakeholder-workshopped messages that can be used in a variety of work settings as part of an exposure control plan for employers with outdoor workers.

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## 1. Introduction

Outdoor workers are exposed to excessive solar ultraviolet radiation (UVR) and heat. These hazards lead to outdoor workers being at risk for skin cancer [1,12,15,20], ocular (eye) disease and damage (ocular melanoma and cataracts) [20], and heat-related illnesses [1,15]. Skin cancer is the most common malignancy in Canada, with approximately 100,000 new diagnoses of melanoma and non-melanoma skin cancers yearly [27], and incidence is increasing [16]. Approximately 4,600 of these non-melanoma skin cancers per year in Canada are attributable to outdoor workers' exposure to the sun [23]. There are an estimated 1.7 million outdoor workers in Canada, defined as those who work outside for 2+ hours per day [4,19].

Increased extreme heat events are additional challenges for workers [3,13]. The risk of heat-related illness for Ontario workers was elevated for men, young workers, and those performing manual labor [7]. Outdoor workers are mostly male (>80% for Canada) [4], and many are young workers [35]. This is concerning as this demographic is less prone to wearing personal protective equipment and taking breaks to reduce heat illness risk, and more prone to taking risks with their health [29].

Messaging surrounding sun safety has previously focused on the general public. However, outdoor workers are at increased risk of negative health outcomes due to long outdoor working hours, and may have limited control over their work activities [18]. While Canadian jurisdictions do not have occupational exposure limits for solar UVR, when compared to the international standard (1.0 to 1.3 standard erythemal doses or per day) [39], Canadian workers are overexposed to solar UVR, sometimes at over 10 times this level [22,25,30].

The Ontario Sun Safety Working Group, the Canadian Cancer Society, and the Canadian Dermatology Association formed a National Steering Committee in 2014–2015 to initiate a national sun safety messaging consensus process. The committee developed a core content for sun safety messages for the general public that balanced the need to reduce UVR exposure and the risk of skin cancer and eye damage with the recognition that eliminating UVR exposure entirely is not practical, achievable, or desirable [18]. As a result, the committee developed and published the “Recommended Core Content for Sun Safety Messages,” hereinafter referred to as the “core sun safety messages” (see [supplementary materials](#)) [18].

The core content was created for the general public, so the messages may not be relevant for working outdoors. For example, the most effective method of preventing UVR exposure in the core content is to seek shade between 11 AM and 3 PM, which is not feasible for most outdoor workers [18,26]. Other messages that may not be appropriate for outdoor workers include specific recommendations for wide-brimmed hats or shade structures that could be unsafe depending on the occupation setting or recommendations to avoid tanning equipment.

Among the many initiatives to reduce workers' UVR exposure, educational interventions have been effective at increasing sun protective behaviors [14]. A review examining the effect of sun safety education interventions across multiple sectors found that interventions can improve workers' knowledge and behaviors [28]. Further, the interventions are most effective when integrated within a sun safety program, particularly when that program is embedded within a workplace's occupational health and safety (OHS) management system [11].

The objective of this study was to develop a core set of practical, harm-reducing messages for sun safety that will resonate more strongly with and be more actionable for outdoor workers and their employers.

## 2. Materials and methods

First, we consulted with the research leads of the “Recommended Core Content for Sun Safety Messaging” to better understand their process and lessons they learned that could be relevant to undertaking a message tailoring activity. A tailored message is a message that has been “fitted” to a specific individual and/or group of people [31]. The research leads provided detailed documentation on the materials used to develop the core sun safety messages. We then established a Steering Committee (SC) that included 10 experts in dermatology, occupational disease, optometry, occupational hygiene, and health promotion. The role of the SC was to review and provide suggestions for the tailored sun safety messages.

A needs assessment was conducted to understand the perspectives of outdoor workers, worker representatives, and employers. The needs assessment included interviews using a semi-structured questionnaire via Zoom with stakeholders, including outdoor workers and OHS professionals in construction, landscaping, transportation, and municipalities. The stakeholders were chosen for invitation based on existing relationships with CAREX Canada, a national carcinogen exposure surveillance program, followed by a web search to identify additional OHS organizations with sun safety interests. The groups selected were purposive, but recruitment was voluntary and reflective of a convenience sample. In all, 11 interviews were conducted for the purposes of the needs assessment. The interviews were recorded, transcribed, and analyzed using an inductive thematic analysis by two coders, who met to reach consensus on any discrepancies [2]. Eight sections that matched the format of the original core content sun safety messages formed the needs assessment, which included: key facts, primary recommended actions for skin protection, primary recommended actions for eye protection, additional recommendations, tips for shade, tips for clothing, tips for sunscreen, and tips for eye protection. The participants were asked whether the core messages were useful and feasible, and if any changes were needed to make them more meaningful and/or actionable for outdoor workers and their employers.

The members of the SC were then presented with the results of the needs assessment and asked to tailor the core sun safety messages to better suit outdoor workers, bearing the needs assessment in mind. To ensure that the tailored sun safety messages were feasible and grounded in evidence-based best practice, we used a modified Delphi method to determine consensus across the SC. The Delphi process uses sequential rounds of voting to achieve consensus [6]. The tailored sun safety messages required 80% agreement to achieve consensus – this is in accordance with studies that have used similar procedures [8,17]. If consensus was not reached, further tailoring and voting were required until the 80% threshold was met or exceeded. In the first round of the Delphi surveying, the SC members were asked an open-ended question “Do you feel the above tailored sun safety message is better suited for outdoor workers? If ‘No’, comment further changes you'd like to see”. They were encouraged to use results from the needs assessment and their own expert opinion when making suggestions. The survey was divided into the same eight sections as the core sun safety messages. A similar format was used for all rounds of the survey. Feedback from this survey was used to create the first draft of the tailored sun safety messages, and edits were made and circulated for review in Round 2. In Round 2, the members of the SC received the revised core sun safety messages, the newly drafted tailored messages, and a summary of anonymized responses from the Round 1 survey in order to support decision-making. The SC were asked whether the tailored messages were better suited for

outdoor workers and if not, to provide further suggestions on required modifications. Response frequencies for each section were calculated, and those that did not meet consensus (80% agreement) were further modified based on the feedback received in Round 2.

A second draft of the tailored messages (i.e., vetted through the Delphi process by the SC) was then presented in a workshop to a group of outdoor workers, worker representatives, and employers to invite feedback that would allow for further revisions to enhance uptake. Workshop participants were recruited via email, similarly to the stakeholders involved in the needs assessment, with an additional nomination for invitation by the steering committee for some members to ensure a diversity of worker, employer, and occupational hygienist experiences ( $n = 11$  participants attended the online workshop). The reader will recall that these messages were initially informed by the results of the needs assessment and then tailored through two rounds of formal consensus building. The workshop was conducted using Zoom, recorded, and transcribed for analysis.

Feedback from the workshop was then presented to the SC during a final meeting (Round 3). This meeting was held over Zoom,

and the members were asked to provide their input on any final changes to the messages. The final set of the tailored sun safety messages for outdoor workers was determined when 80% of the members reached a consensus.

### 3. Results

A brief summary of representative results are provided below by each section of the sun safety messages, and the tailored sun safety messages for outdoor workers are provided in [Fig. 1](#). An overview of the tailoring process from beginning to end is provided in [Table S1](#) in Supplementary Materials.

#### 3.1. General comments

Overall, the stakeholders (including the needs assessment and workshop participants) found the core sun safety messages (for the general public) useful in their own right. However, some stakeholders suggested that separate sets of messages for employers and

#### Key Facts

- Ultraviolet radiation (UVR) from the sun causes skin cancer, cataracts, and other forms of skin and eye damage.
- Skin cancer is the most common cancer in Canada, and one of the most preventable.
- Outdoor workers are at an elevated risk of developing skin cancer and experiencing the harmful effects of sun exposure as they spend a lot of time outdoors.
- The sun's rays are harmful all year round but especially from 11am to 3pm between April and September in Canada.
- Even when it's cloudy, UVR can be harmful.

#### Primary Recommended Actions: Protect your eyes

- Wear safety glasses, sunglasses, or prescription eyeglasses with UV-protective lenses.
- Wear a wide-brimmed hat or attach a brim to your hardhat for added eye protection at work.

#### Tips: Shade

- Where possible, work in natural, dense shade or use a good-quality shade structure that offers shade from the side and not just overhead, to protect against UVR that is reflected and scattered off concrete, water, sand, snow, and light-coloured surfaces.
- As a general guide, wider and denser sources of shade provide increased protection.
- Cloth shade structures should have tightly woven fabric. If sunlight passes through the fabric, it provides less protection.
- Additional personal protective equipment (PPE) (clothes, glasses with UV-protective lenses and sunscreen) is recommended even when in the shade to protect against reflected and scattered UVR.

#### Tips: Sunscreen

- Sunscreen should be used on exposed skin. Remember to apply sunscreen on the ears and neck, and use sunscreen lip balm.
- Use sunscreen that says on the label: "Broad spectrum", "SPF 30 or higher" and "water resistant"
- Use a generous amount of sunscreen and re-apply frequently when doing physically strenuous work.
- Use any type of sunscreen (sprays, lotions, gels or creams) you find easiest to use and apply it properly with thorough coverage.
- Store sunscreen in a cool and accessible place such as a site office instead of hot areas such as the glove compartment of a vehicle. Do not use expired sunscreen as it's less effective.

#### Primary Recommended Actions: Protect your skin

- In Canada, the UV index is generally 3 or higher from 11am to 3pm between April and September, even when it's cloudy. When the UV Index is 3 or higher, protect your skin as much as possible.
- Seek shade when you can. Use tents, tarps or canopies at work when possible. Take breaks in the shade.
- Wear loose protective clothing and hats that cover as much skin as possible, including the face, ears and neck. A brim or neck flap can be attached to caps or hardhats to protect your face, ears and back of neck.
- Use sunscreen labeled "broad spectrum" and "water resistant" with a sun protection factor (SPF) of at least 30. Apply sunscreen generously and re-apply frequently.
- Use a lip balm with an SPF of at least 15.

#### Additional Recommendations

- Check the daily forecast at the start of the workday for the UV Index and protect your skin accordingly.
- Between April and September, whenever possible, plan any unshaded outdoor work for before 11 a.m. or after 3 p.m.
- Avoid working outdoors without shade during the hottest time of the workday when possible.

#### Tips: Clothing

- Hats should shade the head, face, ears, and back of the neck with a wide brim or neck flap.
- Light-coloured, tightly woven or UV-protective labelled clothing is recommended.

#### Tips: Eye Protection

- UVR that is harmful to the eyes is present in the sun's rays all year round and throughout the workday.
- Eye protection is required, especially around highly reflective surfaces, such as buildings, snow, sand and water.
- Wear close-fitting, wraparound, UV protective sunglasses or safety glasses for the best UV eye protection.
- Look for safety glasses, sunglasses, or prescription lenses with full UVA and UVB protection. Examples of appropriate labels are "UV400" or "100% UV protection."

**Fig. 1.** Tailored sun safety messages for outdoor workers.

workers may be useful. The stakeholders also suggested that messages be tailored based on occupation, and tailoring the message according to workplace may have merit. The stakeholders mentioned that developing useful knowledge products such as infographics would be critical for an uptake of the messages by outdoor workers and their employers.

### 3.2. Key facts

The needs assessment uncovered that some of the core messages are wordy and the tailored messages could be more succinct. We also heard that using examples relevant to outdoor workers was important. For example, tanning beds are not a concern related to an outdoor work setting. The majority of the SC wanted the key facts to be simplified. The SC also emphasized the importance of including the time when UVR risk is greatest (11 AM–3 PM), sources of UVR, and potential harmful effects (e.g., skin cancer) in the tailored sun safety messages.

The workshop participants noted that descriptions of skin damage (wrinkling and photo-aging) will not resonate with most outdoor workers. The participants suggested we use alternate messages, such as skin cancer statistics or quantifying outdoor workers' increased skin cancer risk compared to the general population.

### 3.3. Primary recommended actions: protect your skin

The stakeholders questioned the practicality of outdoor workers using their own shade, such as an umbrella, which is provided as an example in the core messages. Instead, tarps, canopies, or tents would be a more appropriate example. The stakeholders also discussed the importance of the UV Index. One stakeholder recommended including additional information on the UV Index as a footnote, while others questioned the importance of outdoor workers knowing the UV Index at all. The message requiring protection between 11 AM and 3 PM was received positively by all of the stakeholders and was regarded as important to keep, but some stakeholders noted that this is a challenging recommendation for outdoor workers to follow. In addition, it was noted that some workers may also be challenged in using sunscreen due to dusty work conditions.

Several members of the SC agreed that an umbrella was not an appropriate example for shade in an outdoor workplace and that other structures would be more appropriate. The SC also recommended keeping the UV Index messaging. Interestingly, only two SC members mentioned the importance of the second bullet point regarding tanning equipment in their survey responses.

The workshop did not reveal any additional recommendations that directly related to outdoor workers protecting their skin. It was suggested that tailored messages should mention “workplace representatives” or “joint health and safety committees” to help direct workers to additional resources. There was a discussion about how the hierarchy of controls could be used in sun safety messaging.

### 3.4. Primary recommended actions: protect your eyes

The stakeholders found that the eye protection messages were feasible for outdoor workers. Though, several mentioned that the messaging should also include “safety goggles and glasses” to make it better suited for some outdoor workers. The majority of the SC survey responses supported the addition of safety goggles/glasses to the messaging, and the importance of UVR-blocking or polarized lenses was also mentioned. A suggestion was made during the

workshop to rephrase the eye protection message so the onus is not on the worker.

### 3.5. Additional recommendations

The possibility of workers avoiding sun exposure between 11 AM and 3 PM was discussed again while reviewing the additional recommendations during the needs assessment. Some stakeholders stated that it was very important to include this message, even though following it may be challenging. The message regarding balancing the risks and benefits of sun exposure in the context of vitamin D was also discussed. Many stakeholders noted that it was irrelevant to outdoor workers, as they are not voluntarily being exposed for health benefit. Most members of the SC also agreed that the vitamin D messaging was irrelevant.

### 3.6. Tips: shade

The stakeholders were in agreement that the tips on shade were appropriate for outdoor workers. A stakeholder pointed out that outdoor workers may not be able to find shade. The members of the SC also acknowledged that available shade would vary by workplace. There was also a discussion on the message regarding sources of shade, and a stakeholder suggested including information about the color of fabric and reflectivity.

Both the stakeholders and the SC agreed that including a message on scattered UVR was important. Scattered UVR was also raised during the workshop, and the participants suggested including examples of surfaces that could scatter UVR (e.g., concrete, water, and light-colored surfaces). The workshop participants also suggested rephrasing messaging to address the fact that outdoor workers may not be able to find shade (e.g., “where possible, work in [...] shade” or “try and take lunch breaks in the shade”).

### 3.7. Tips: clothing

The stakeholders thought the tips on clothing were clear. A stakeholder suggested that it may be helpful to include information on recommended clothing colors and more guidance on tightly woven materials and UVR protective clothing. UVR-protective-labeled clothing was also discussed by the SC in their survey responses. It was noted that this tip may give the impression that sunscreen is not important. A final piece of feedback from the workshop was that the messages should suggest outdoor workers wear a hat with a “wide brim and neck flap”.

### 3.8. Tips: sunscreen

The majority of the stakeholders found the lip balm reminder to be important for outdoor workers. The stakeholders also recommended that the messages should specifically mention applying sunscreen to the ears and the back of the hands as these areas tend to be forgotten. There was also a discussion on the message that details the volume of sunscreen to use. Some stakeholders thought the description would be of no use to outdoor workers, and some alternative ways to describe the amount of sunscreen that should be applied were provided. There were also some suggestions on how we could tailor this message to be based on “exposed skin”.

Generally, the members of the SC found the core sun safety messages for sunscreen to be well worded. It was suggested that the second (amount of sunscreen) and third bullet (re-apply) points be tailored to make them more relevant for outdoor workers. Also, some members suggested adding a specific message about putting sunscreen on the ears, lips, and back of neck.



Workshop participants echoed the suggestion on adding the back of the hands to the messages. Regarding the recommended amount of sunscreen, some workshop participants liked that the recommended amount was quantified, while others suggested changing it to something more relatable (e.g., handful). It was also suggested that the tailored messages include information on the expiry and storage of sunscreen.

### 3.9. Tips: eye protection

The stakeholders provided several ways to tailor the eye protection tips, including designated words used to describe UVR protection for eyewear and the protectiveness of sunglasses without UVR protection labels. The importance of close-fitting wrap-around glasses for outdoor workers was mentioned. The stakeholders also appreciated that the core messages mentioned reflective surfaces as an important consideration.

Generally, the SC found the eye protection messages to be clear but suggested a few changes, including a re-phrasing of the message on UVR harm to be more direct. It was also suggested to add mention of safety glasses throughout the eye protection tips.

The workshop participants also suggested re-phrasing several of the messages to improve flow and clarity. A workshop participant also recommended removing the messages regarding contact lenses, as these messages may deter people from using sunglasses.

## 4. Discussion

There has been limited research conducted in Canada to assess the levels of awareness and engagement among outdoor workers regarding sun safety. Examples include the 1996 Canadian National Survey, which included 546 self-identified outdoor workers (of 4,023 participants) [33], and the Second National Sun Survey (2006), which surveyed 1,337 outdoor workers [19]. Two more recent studies asked outdoor workers about their sun protection practices while at work and leisure [24,30]. Generally, research demonstrates that outdoor workers are receptive to sun safe practices, and educational interventions can be effective at increasing protective behaviors [14], improving workers' knowledge and their sun protection behaviors [28].

This study fills a key gap identified by the authors of the core sun safety messages—messages created for the general population may not be applicable to all settings and that they should be tailored to protect unique and/or highly susceptible subpopulations [18]. We have created a set of evidence-based, expert- approved, and stakeholder- workshoped messages for use in a variety of work settings as part of a sun safety program. These tailored messages consider what is feasible and practical for outdoor workers. The occupational language of safety and personal protective equipment, e.g., is included in the tailored messages, with such messages providing an important component of the worker training element of a sun safety program [11]. However, structural changes to workplace policies and practices may also be required to reduce UVR exposure among outdoor workers.

Our approach was innovative because it followed the paradigm of harm reduction. Harm reduction refers to “interventions aimed at reducing the negative effects of health behaviors without necessarily extinguishing the problematic health behaviors completely or permanently” [10]. Though originally developed to mitigate the impact of infectious diseases and substance abuse, it bears striking relevance to solar UVR, which by definition cannot be completely extinguished. Indeed, the inability for outdoor workers to completely avoid UVR exposure was a key message that was echoed throughout the tailoring process. Reducing workers' UVR exposure is key, and has been a theme of occupational sun safety

programs, targeted through various administrative policies, environmental controls, and education programs [11,37]. Of the approximately 1.7 million Canadian workers exposed to solar UVR at work, the majority (53% or 871,000) is exposed to high levels, meaning they spend  $\geq 75\%$  of their workday outdoors [4]. Outdoor work is required in many sectors, so it is not feasible to eliminate occupational UVR exposure entirely, but reducing UVR exposure for 10% of Canadian workers could have a significant public health impact [4,34]. The tailored sun safety messages can form the basis of communications for outdoor workers to understand their risk and take actionable measures to reduce their exposure.

There are clear future steps for research in sun safety for outdoor workers. Firstly, the messages should be implemented in at least one setting and formally evaluated. This is of particular interest as research comparing the effectiveness of general sun safety messages to tailored messaging for outdoor workers is limited. A previous study found that in comparison to generic messages, tailored messages for outdoor workers were more effective for promoting sun protection behaviors [5]. Interestingly, tailored (i.e., “fitted [31]”) messaging for outdoor workers was found to be as equally effective as targeted messaging (i.e., “aimed” [31]) [5]. Though, other studies have suggested that tailored messaging is generally more effective than targeted messages, and tailored messages have been successfully used for other skin cancer prevention efforts [5,9].

At present, the tailored messages we have developed have not been formally evaluated as this was beyond the scope of our work. However, if an evaluation revealed that our tailored sun safety messages for outdoor workers were indeed more effective than generic messaging, it would be important to explore *why* they are effective and the specific impacts on outdoor workers' knowledge, attitudes, and behaviors related to UVR exposure [21]. Finding the effective components could allow us to further tailor messages for certain worker groups, as suggested by our stakeholders. In particular, high-risk workers (e.g., construction workers, farmers, landscapers) could be targeted based on estimated exposure to UVR. For example, in Canada, the construction industry has the greatest number of workers potentially exposed to UVR (416,000 workers exposed), followed by farms (200,000), and services to buildings and dwellings (104,000) [4]. Based on occupation, the greatest number of exposed workers are farmers and farm managers (198,000 workers exposed), construction trades helpers (149,000), and landscaping and grounds maintenance laborers (116,000) [4]. Likewise, in the United States, data indicate that the majority (90%) of landscaping workers and construction laborers (79%) spend more than two-thirds of their workday outside [36]. Tailoring messages could also be explored for employers or specific workplaces, as suggested by some of our stakeholders.

The main strength of this study is the implications it has for policy and prevention measures to protect the health and safety of outdoor workers. The tailored sun safety messages can be used by regulators, OHS representatives, labor organizations, and employers. Notably, our tailored sun safety messages have already been disseminated into practice by WorkSafeBC (Workers' Compensation Board of British Columbia) on their webpage [38], and are used by inspectors to address occupational solar UVR through education and awareness raising. Dissemination of tailored messages is a common barrier, even including messages previously determined to be efficacious [21]. The use of an integrated knowledge translation approach involving experts and stakeholders throughout may have helped us overcome this barrier. Lastly, another strength was that we used a validated procedure (the modified Delphi approach), which is known to be reliable in occupational settings [6]. As such, our methods could be replicated to create tailored messages to prevent other occupational exposures.

Our study also had some limitations. Firstly, not all the members of the SC were present during the first round of the survey, although during subsequent surveys and the final meeting, feedback was received from all the members. Second, there is a possibility that if we had different experts or stakeholders than our final tailored messages may have been different. However, we believe that starting the process with established sun safety messages and using the Delphi method and an integrated knowledge translation approach have minimized this possibility. Finally, while the messages we present on sunscreen reflect the consensus results of our study, it is important to mention that emerging evidence suggests that lotion sunscreens may be more effective for skin cancer prevention and less harmful to the environment (and potentially to human health) [32].

We developed a set of evidence-based, expert-approved, and stakeholder-workshopped tailored sun safety messages for outdoor workers. The messages provide users with key facts, recommendations, and tips related to preventing skin cancer, eye damage, and heat stress, mindful of the feasibility for outdoor workers. These messages are relevant for use by regulators and other stakeholders. Future work should formally evaluate tailored messaging to demonstrate effectiveness in improving sun protective behaviors. This could reveal the specific effective components, and allow for tailoring of messages for certain high-risk worker groups (e.g., construction workers, farmers, landscapers) as suggested by our stakeholders.

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## Ethics statement

This study was approved by the Health Research Ethics Board of Alberta Cancer Committee (HREBA.CC-19-0463).

## Conflicts of interest

The authors declared no conflicts of interest.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.shaw.2023.01.001>.

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