

# Further Guidance in Implementing the Standardized 2018 World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR) Score



Marissa M. Shams-White<sup>1</sup>, Dora Romaguera<sup>2,3,4</sup>, Panagiota Mitrou<sup>5</sup>, Jill Reedy<sup>1</sup>, Alice Bender<sup>6</sup>, and Nigel T. Brockton<sup>6</sup>

## ABSTRACT

The 2018 World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR) Score was developed to establish a simple, standardized scoring system for researchers to quantify adherence to the 2018 WCRF/AICR Cancer Prevention Recommendations and assess its impact on cancer risk and other health-related outcomes. The aim of this commentary is to clarify potential points of ambiguity in its application, focusing on aspects related to specific subscore components (physical activity, fast foods, alcohol,

and sugar-sweetened drinks), how to address different data needs due to varied data collection instruments, and future exploratory score approaches. Overall, we encourage researchers to utilize the standardized score to enhance comparability across populations and countries. Researchers who may adapt or augment the 2018 WCRF/AICR Score are strongly encouraged to provide detailed descriptions of their methods to promote transparency and reproducibility.

## Introduction

In 2018, it was estimated that 30% to 50% of the world's cancer cases may be preventable (1–5). The World Cancer Research Fund (WCRF) and American Institute for Cancer Research (AICR) published *Diet, Nutrition, Physical Activity, and Cancer: A Global Perspective, the WCRF/AICR Third Expert Report* in 2018. This report summarized the global research on diet, nutrition, physical activity, and cancer and updated the 10 evidence-based Cancer Prevention Recommendations on modifiable lifestyle behaviors that impact cancer risk.

The 10 Cancer Prevention Recommendations represent a package of healthy lifestyle behaviors, focusing on following a healthy diet, maintaining a healthy body weight, and engaging in regular physical activity (Table 1; refs. 6, 7). Studies show that following the previous iteration of these recommendations, first published in the 2007 WCRF/AICR Second Expert Report, is associated with reduced cancer risk and improved outcomes after a diagnosis (8–27). However, there was no unified approach to measuring the adherence to the former recommendations; each study developed their own scoring system and this made comparisons between studies difficult.

Following the publication of the Third Expert Report, our group embarked on a project to define a standardized approach to measure adherence to the 2018 WCRF/AICR Cancer Prevention Recommendations. This initiative, which was guided by feedback from the Continuous Update Project (CUP) Expert Panel who developed the Recommendations, culminated in the recent publication of the standardized 2018 WCRF/AICR score (7). Eight of the 10 recommendations are operationalized as components of the score; each component receives 0 to 1 point (1, 0.5, and 0 points for meeting, partially meeting, and not meeting each recommendation, respectively). One component addressing breastfeeding is optional, leading to a total score range of 0 to seven or eight points as shown in Table 2. Our goal was to establish a simple, standardized scoring system for researchers to study how adherence to the 2018 WCRF/AICR Cancer Prevention Recommendations may impact cancer and other health-related outcomes, and to support the comparability of studies' findings across different populations and countries.

The aim of this commentary is to support researchers interested in utilizing the score and to clarify potential points of ambiguity in its application. Although there are many potential considerations depending on the research question(s) of interest and the epidemiological study design (e.g., depending on if one is conducting an observational, intervention, or surveillance study), we focus below on aspects related to specific subscore components; how to address different data needs; and exploratory score efforts. In particular, we encourage researchers to provide detailed descriptions of how they apply the 2018 WCRF/AICR score (7) to promote transparency and reproducibility.

## Clarification on Subscore Components

The Cancer Prevention Recommendations were developed for the general public to provide evidence-based advice on how to make healthy lifestyle choices; they were not developed to be applied as a research tool to measure lifestyle habits in epidemiologic studies. We thus adapted the recommendations for research purposes (7) and herein further elucidate four subscores below—physical activity, fast foods, alcohol, and sugar-sweetened drinks—to provide more guidance on how they were operationalized and how they could be considered in different datasets and populations.

<sup>1</sup>Risk Factor Assessment Branch, Epidemiology and Genomics Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute, Bethesda, MD. <sup>2</sup>Balearic Islands Health Research Institute (IdISBa), University Hospital Son Espases, Illes Balears, Spain. <sup>3</sup>Barcelona Institute for Global Health (ISGlobal), Barcelona, Spain. <sup>4</sup>CIBER Physiopathology of Obesity and Nutrition (CIBEROBN), Madrid, Spain. <sup>5</sup>World Cancer Research Fund International, London, United Kingdom. <sup>6</sup>American Institute for Cancer Research, Washington, DC.

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**Corresponding Author:** Marissa Shams-White, National Cancer Institute, 9609 Medical Center Drive, Bethesda, MD 20892. Phone: 240-276-7654; E-mail: [marissa.shams-white@mail.nih.gov](mailto:marissa.shams-white@mail.nih.gov)

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**Table 1.** The 2018 WCRF/AICR recommendations for cancer prevention.

Recommendations	Details	Goals
1. Be a healthy weight <sup>a</sup>	Keep your weight within the healthy range and avoid weight gain in adult life	<ul style="list-style-type: none"> <li>Ensure that body weight during childhood and adolescence projects toward the lower end of the healthy adult BMI range.</li> <li>Keep your weight as low as you can within the healthy range throughout life.<sup>a</sup></li> <li>Avoid weight gain (measured as body weight or waist circumference) throughout adulthood.</li> </ul>
2. Be physically active <sup>a</sup>	Be physically active as part of everyday life—walk more and sit less	<ul style="list-style-type: none"> <li>Be at least moderately physically active, and follow or exceed national guidelines.<sup>a</sup></li> <li>Limit sedentary habits.</li> </ul>
3. Eat a diet rich in whole grains, vegetables, fruit, and beans <sup>a</sup>	Make whole grains, vegetables, fruit, and pulses (legumes) such as beans and lentils a major part of your usual diet	<ul style="list-style-type: none"> <li>Consume a diet that provides at least 30 g/day of fiber from food sources.<sup>a</sup></li> <li>Include in more meals foods containing whole grains, nonstarchy vegetables, fruit, and pulses (legumes) such as beans and lentils.</li> <li>Eat a diet high in all types of plant foods, including at least five portions or servings (at least 400 g or 15 oz in total) of a variety of nonstarchy vegetables and fruit every day.<sup>a</sup></li> <li>If you eat starchy roots and tubers as staple foods, eat nonstarchy vegetables, fruit, and pulses (legumes) regularly too if possible.</li> </ul>
4. Limit consumption of “fast foods” and other processed foods high in fat, starches, or sugars <sup>a</sup>	Limiting these foods helps control calorie intake and maintain a healthy weight	Limit consumption of processed foods high in fat, starches, or sugars, including “fast foods,” many prepared dishes, snacks, bakery foods and desserts, and confectionery (candy). <sup>a</sup>
5. Limit consumption of red and processed meat <sup>a</sup>	Eat no more than moderate amounts of red meat, such as beef, pork, and lamb. Eat little, if any, processed meat.	If you eat red meat, limit consumption to no more than about three portions per week. Three portions are equivalent to about 350 to 500 g (about 12–18 oz) cooked weight of red meat. Consume very little, if any, processed meat. <sup>a</sup>
6. Limit consumption of sugar-sweetened drinks <sup>a</sup>	Drink mostly water and unsweetened drinks	Do not consume sugar-sweetened drinks. <sup>a</sup>
7. Limit alcohol consumption <sup>a</sup>	For cancer prevention, it is best not to drink alcohol	For cancer prevention, it's best not to drink alcohol. <sup>a</sup>
8. Do not use supplements for cancer prevention	Aim to meet nutritional needs through diet alone	High-dose dietary supplements are not recommended for cancer prevention—aim to meet nutritional needs through diet alone.
9. For mothers: breastfeed your baby, if you can <sup>a</sup>	Breastfeeding is good for both mother and baby	This recommendation aligns with the advice of WHO, which recommends infants are exclusively breastfed for 6 months, and then up to 2 years of age or beyond alongside appropriate complementary foods. <sup>a</sup>
10. After a cancer diagnosis: follow our recommendations, if you can	Check with your health professional for what is right for you	<ul style="list-style-type: none"> <li>All cancer survivors should receive nutritional care and guidance on physical activity from trained professionals.</li> <li>Unless otherwise advised, and if you can, all cancer survivors are advised to follow the Cancer Prevention Recommendations as far as possible after the acute stage of treatment.</li> </ul>

Abbreviations: g, grams; oz, ounces; WHO, World Health Organization.

<sup>a</sup>This recommendation or goal is operationalized in the 2018 WCRF/AICR score.

### Physical activity

The Third Expert Report recommended that the public should follow or exceed their national guidelines. As a result, our paper (7) operationalized the WCRF/AICR Third Expert Report's physical activity recommendation based on U.S. national guidelines, which aligned with the WHO's guidelines at the time of publication (**Table 1**; ref. 28). However, we recognize that other countries may have guidelines that differ from the United States and WHO and recommend that researchers adapt this component of the score to align with the appropriate/relevant guidelines for the context of their study.

### Fast foods and ultraprocessed foods

To examine adherence to the recommendation, “Limit consumption of ‘fast foods’ and other processed foods high in fat, starches, or sugars,” the score focuses on the quantity of ultraprocessed foods (UPFs) in participants' diets. An adapted UPF (aUPF) variable was created on the basis of the NOVA classification system (29). Depend-

ing on the amount of processing food or food products undergo in preparation for consumption, NOVA classifies them into one of four groups: unprocessed or minimally processed foods; processed culinary ingredients; processed foods; or UPF and drink products (29). The definition of aUPF was altered to remove items within the UPF and drink products group already addressed elsewhere in the score (sugar-sweetened drinks and red and processed meat UPF items) and to match the aforementioned definition from the 2018 WCRF/AICR Third Expert Report, which includes many prepared dishes, snacks, bakery foods and desserts, and confectionery (candy; **Table 1**). Given the inclusion of processed starches in the WCRF/AICR recommendation, depending on the amount of preservatives and additives used, some foods made of refined grains may be included in the aUPF variable (e.g., some types of white bread, refined pasta, and pizza may or may not be considered aUPFs). We encourage authors to clearly specify the categorization selected for any potentially ambiguous items. Rather than recommending objective cut-points, we recommend that

**Table 2.** Definitions of scoring thresholds for components of the 2018 WCRF/AICR score.

2018 WCRF/AICR recommendations	Operationalization of recommendations	Points	
1. Be a healthy weight	BMI (kg/m <sup>2</sup> ) <sup>a</sup>	18.5–24.9	0.5
		25–29.9	0.25
		<18.5 or ≥30	0
	Waist circumference [cm (in)] <sup>a,b</sup>	Men: <94 (<37)	0.5
		Women: <80 (<31.5)	
		Men: 94–<102 (37–<40)	
		Women: 80–<88 (31.5–<35)	0.25
		Men: ≥102 (≥40)	
		Women: ≥88 (≥35)	
	2. Be physically active	Total moderate-vigorous physical activity (min/wk) <sup>c</sup>	≥150
75–<150			0.5
<75			0
3. Eat a diet rich in whole grains, vegetables, fruit, and beans			Fruits and vegetables (g/day) <sup>d</sup>
	200–<400	0.25	
	<200	0	
	Total fiber (g/day) <sup>d</sup>	≥30	0.5
		15–<30	0.25
		<15	0
4. Limit consumption of “fast foods” and other processed foods high in fat, starches, or sugars	Percent of total kcal from ultraprocessed foods (aUPFs) <sup>e</sup>	Tertile 1	1
		Tertile 2	0.5
		Tertile 3	0
		5. Limit consumption of red and processed meat	Total red meat (g/wk) and processed meat (g/wk)
Red meat <500 (18 oz) and processed meat 21–<100 (0.75 oz–<3 oz)	0.5		
Red meat >500 or processed meat ≥100 (≥3 oz)	0		
6. Limit consumption of sugar-sweetened drinks	Total sugar-sweetened drinks (g/day)		
		>0–≤250 (8.5 oz)	0.5
		>250 (8.5 oz)	0
		7. Limit alcohol consumption <sup>f</sup>	Total ethanol (g/day)
>0–≤28 (2 drinks) males and ≤14 (1 drink) females	0.5		
>28 (2 drinks) males and >14 (1 drink) females	0		
8. (Optional) For mothers: breastfeed your baby, if you can	Exclusively breastfed over lifetime for a total of (mo)		
		>0–<6	0.5
		Never	0
		Total score range	0–7 (or 0–8)

Abbreviations: cm, centimeters; g, grams; in, inches; kcal, kilocalorie; kg, kilograms; m, meters; min, minutes; mo, months; oz, ounces; wk, week.

<sup>a</sup>Scoring note: When data are available for both BMI and waist circumference, the sum of the two will be used to score. When only one is available, the point values will be doubled to score (i.e., in both scenarios, this subcomponent's total range will remain 0–1).

<sup>b</sup>The 1-point cutoff point is based on the 2018 WCRF/AICR recommendation; the 0.5- and 0-point cutoff points are based on Centers for Disease Control and Prevention (37) and National Heart, Lung, and Blood Institute (39) guidelines.

<sup>c</sup>The 1-point cutoff point is based on the minimum recommendation. The 0.5- and 0-point cutoff points are based on additional data from the U.S. Physical Activity Guidelines (40).

<sup>d</sup>Scoring note: The scoring of this recommendation is consistent with previous approaches used in many past 2007 WCRF/AICR recommendation-based scores (2), in which meeting at least half the recommendations (i.e., the fruit and vegetable recommendation or the fiber recommendation) earns 0.5 points.

<sup>e</sup>The UPF variable was created on the basis of the NOVA classification system (41). Food items already included in other components of the score (i.e., sugar-sweetened drinks, red meats, and processed meat UPF items) were removed from the original NOVA UPF variable to create the 2018 WCRF/AICR score adapted aUPF variable.

<sup>f</sup>The 1-point cutoff point is based on the 2018 WCRF/AICR recommendation. The 0.5- and 0-point cutoff points are based on additional data from the 2015 to 2020 U.S. Dietary Guidelines for Americans (42).

aUPF intake be grouped in tertiles for analysis so that intake is relative to others in the given population; this avoids inappropriate comparisons to intakes in other populations with differing amounts of aUPFs in their food systems.

It is important to note that, similar to refined grains, the inclusion of other foods such as yogurt and milk alternatives in the aUPF variable is dependent on their source. For example, if the dietary instrument used in a study stratifies plain yogurt from sweetened and flavored yogurts, the latter should be included in the aUPF variable. However, if this distinction is unavailable (i.e., all yogurts are addressed together), they should not be included to avoid penalizing participants who consume plain yogurt as part of their regular diet. This is particularly important in countries whose food systems primarily include plain yogurt. A similar approach should be taken with milk products and milk alternatives (e.g., soy and nut milks): if the dietary instrument differentiates between plain and sweetened/flavored items (e.g., vanilla or chocolate milk) only the latter needs to be included in the aUPF variable; if the distinction is not made, they should be excluded from the aUPF variable.

Overall, we additionally urge researchers to carefully study the NOVA classification system to create an aUPF variable appropriate to their dietary instruments, the period of data collection, and their study populations. The sample aUPF list in our previous publication (7) is relevant to the Food Frequency Questionnaire (FFQ) used in the NIH—AARP Diet and Health Study (e.g., items such as ultra-processed meat substitutes were not as popular and thus not captured in the FFQ administered in the mid-1990s) and is likely not directly translatable to aUPF variables derived in other studies.

### Alcohol

The Third Expert Report recommends the public avoid alcohol (1 point); those who do consume alcohol should not exceed the national guidelines. In the score, those who meet national guidelines receive 0.5 points, whereas those who exceed the recommendation receive 0 points. Similar to physical activity, given that part of the alcohol subscore is based on national guidelines, our paper focused on U.S. national guidelines. However, what constitutes a drink (alcohol content, serving size) and the sex-specific cutoff points may vary by country; researchers should account for these differences when utilizing the score.

It is also important to highlight that there is not a standard definition of “zero” alcohol intake or a “nondrinker” across studies. Given the limited evidence comparing nondrinkers to very rare drinkers, our recommendation is to define a participant who consumes up to 1 drink/month as a nondrinker (30); consuming more than one drink/month falls within the 0.5 and 0 cutoff point categories, depending on the amount consumed.

### Sugar-sweetened drinks

The Third Expert Report recommends that the public drink mostly water and unsweetened drinks and avoid sugar-sweetened drinks (1 point). The score further stratifies those who consume up to 250 g (8.5 oz) of sugar-sweetened drinks per day (0.5 points) from those that exceed 250 g per day (0 points). The definition of “zero” drinks or a “nondrinker” varies across studies (31–33). Our recommendation based on the cancer as well as obesity literature (31, 34) is to define a participant who consumes up to 250 g/month (8.5 oz or about one serving/month) as a nondrinker; consuming more falls within the 0.5 and 0 cutoff point categories, depending on the amount consumed.

## Approaches with Limited Data Collection Instruments

The 2018 WCRF/AICR score can be derived from most commonly used, detailed lifestyle assessment data collection methods. For example, dietary components can be assessed on the basis of data from FFQs, 24-hour recalls, and even food records; physical activity data can be collected via self-report physical activity questionnaires or accelerometers. However, some studies may include fewer items on a given component compared with others or may collect frequency per week but not quantity. Questionnaires may also include specific fast-food questions (e.g., focusing on frequency of eating out at restaurants and/or fast food establishments) or, conversely, be missing measures for aUPF data. The latter may be due to the use of older assessment instruments or the analysis of older data, when there was a lower prevalence of UPFs in a given food system (35, 36).

In instances where studies do not include adequate measures that align with the standardized scoring system, the 2018 WCRF/AICR Score may be adapted to assess adherence. For example, if objective red and processed meat intake or physical activity cutoff points are not feasible for a study given that only frequency per week was assessed and not dosage (e.g., missing grams or minutes/week, respectively), subjective tertiles may be used similar to the fast food subscore to stratify participants.

There is much we do not know about the impact of modifications to the score measures; implications of such changes are an area for future research. Regardless of the alternate path chosen, we recommend that researchers apply the score definitions as closely as possible and explicitly state all deviations from the standard score.

## Exploratory Efforts Adapting the Score

Although we encourage the use of the standardized 2018 WCRF/AICR score by researchers, we also encourage exploratory efforts to adapt and improve the utility of the standardized score. We highlight two main areas below, related to operationalizing additional goals and recommendations and examining different subscore cutoff points.

### Including recommendations and goals not currently operationalized

Two recommendations are currently not included in the score: “Do not use supplements for cancer prevention” and “After a cancer diagnosis: follow our Recommendations if you can” (Table 1). As previously mentioned (7), the latter encompasses the other nine Cancer Prevention Recommendations and was thus excluded from the standard Score. However, we support exploratory efforts if researchers have access to detailed data on dietary supplement use and/or are working with a population of cancer survivors and have a novel way of addressing the recommendations.

In addition, there are several goals specified under each recommendation that were not operationalized. For example, one goal specified under “Be physically active” is to “Limit sedentary habits” (Table 1). Researchers may choose to explore the assessment of sedentary habits as a subscore component if they collected validated subjective or objective measures of sedentary behavior. Similarly, for the recommendation to “Be a healthy weight” (Table 1), researchers may choose to explore childhood body weight measures as part of the score or address weight trajectory over time through repeated body weight measures.

### Creating different subscore cutoff points

Alternative subscore cutoff point values may be explored, although we do not recommend them as replacements for the standardized 2018 WCRF/AICR score so as to maintain comparability across studies (e.g., researchers could report results with the standard score as well as with their adapted score). One key example is regarding body mass index (BMI). The score's cutoff points (Table 2) for underweight, normal weight, overweight, and obese are from the 2018 WCRF/AICR Recommendations and are further supported by guidance from the WHO and Centers for Disease Control and Prevention (CDC; ref. 37). However, researchers may wish to explore other evidence-based BMI cutoff points, for example, in Asian populations (38). Depending on national guidelines, other cutoff points may also be explored for alcohol, physical activity, and even the aUPF variable (Table 2).

Furthermore, we plan to explore adjusting cutoff points and other methodologic considerations in future work. For example, we will explore cutoff point adjustments for the sugar-sweetened drink and alcohol subscores, particularly around the differentiation between absolute nonconsumers versus rare consumers; we welcome similar methodologic efforts.

### Future work

The 2018 WCRF/AICR score assesses adherence to the Cancer Prevention Recommendations in a standardized way that enhances comparability of studies' findings across populations. Previous work with past scores suggest that the relationship between the score and cancer-related risks may not be linear: a one-point increment increase in the score from 0 to 1 may be different from a score increase from 1 to 2 or 7 to 8. It is thus important for researchers to consider if there are linear or nonlinear associations between the score and their health outcomes of interest. For linear effect estimates, we recommend that researchers report 1-point increments to promote uniformity across studies. In addition, it is important to note that at this time, we do not have guidance regarding a priori categorizations of the total score, given that it may depend on the distribution of the score in a certain population. We encourage researchers who apply their own categories to provide their rationale and full range of the score within the selected

categories to enhance interpretation of results and enable future comparisons.

Finally, as mentioned previously (7), the current score weighs each recommendation equally with the same three-level approach for each score component (1, 0.5, and 0 points). Exploratory efforts are needed to examine the effects of reweighting both between components (i.e., Should some components be weighted more than others?) and within components (e.g., Should a female who drinks two drinks daily be treated similarly to a female who drinks six drinks daily? Should higher amounts of total physical activity be rewarded with a higher Score?). It is only through our joint efforts in a variety of contexts and populations that we can examine the impact of the score and consider various weighting strategies.

## Conclusions

The 2018 WCRF/AICR Score provides a standardized scoring system for researchers to implement to examine how adherence to the 2018 WCRF/AICR Cancer Prevention Recommendations is associated with cancer-related outcomes across populations and countries. Following the release of the score, we aimed through this commentary to preemptively address implementation questions related to specific subscore components, limited data collection instruments, and exploratory efforts. We again strongly encourage researchers to use the standard score when possible. If any alterations are made, researchers should clearly document where they depart from the published score (e.g., change cutoff points due to national guidelines, add additional constructs, or abbreviate the score due to data limitations) to support transparency.

### Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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