

Title: Dietary choices following a cancer diagnosis: a narrative review

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3 Abstract

4 Individuals with cancer may be motivated to make lifestyle changes and inform dietary choices  
5 yet are exposed to conflicting and erroneous nutritional information, particularly from online and  
6 social media sources. Changes to dietary choices that stem from a diagnosis of cancer are not  
7 fully understood. Thus, we conducted a narrative review to summarize the literature focused on  
8 dietary choices post-cancer diagnosis and highlight influential factors. Post-diagnosis dietary  
9 changes have been studied primarily in females with breast cancer in European countries.  
10 Reported changes typically included decreased red and processed meat intake and increased  
11 consumption of fruit and vegetables. These changes align with recommendations for cancer  
12 prevention but were implemented post-diagnosis and may not meet the nutrition guidelines for  
13 patients with cancer. Age and time since diagnosis were among influential factors that affected  
14 these post-diagnosis changes. Data on dietary changes implemented post-diagnosis in varying  
15 cancer types in the North American population are lacking and would provide practitioners with  
16 an enhanced understanding of patient information needs and reasons for dietary choices.

17

18 Keywords: dietary change; dietary choice; food choice; nutrition; cancer

19

20 *Introduction*

21 The impact of cancer on dietary intake is an essential consideration, because optimized nutrition  
22 status plays an important role in cancer-related outcomes (1-5). For many patients, receiving a  
23 diagnosis of cancer is a motivator for positive lifestyle changes, including changes in dietary  
24 intake (6). Patients and their families may seek information to inform dietary choices (6, 7) but  
25 are challenged with the abundant availability of conflicting and erroneous cancer-related  
26 information, particularly from online and social media sources (8, 9).

27 In order to provide evidence-based patient-oriented nutrition information and education,  
28 practitioners must first gain a solid understanding of determinants of dietary choice throughout  
29 the cancer continuum. Despite the plethora of factors that influence dietary choices in cancer,  
30 post-diagnosis dietary choices are not fully understood. This narrative review focuses on dietary  
31 choices following a cancer diagnosis and highlights selected factors that ultimately affect dietary  
32 intake.

33

34 *Patients with Cancer as a Nutritionally Vulnerable Population*

35 Individuals with newly-diagnosed cancer are nutritionally vulnerable due to the disease and  
36 treatment side effects (10) which put them at increased risk for disease-related malnutrition (11),  
37 **Figure 1.** Older age, weight loss, tumor site (e.g., head and neck, lung, upper gastrointestinal)  
38 and advanced stage of cancer are among factors that increase risk for malnutrition (12, 13).  
39 General changes to dietary intake are captured in most nutrition screening tools (14-18) although  
40 the resulting impact on nutritional status may not be adequately predicted. A distinguishing  
41 element and diagnostic criterion of malnutrition is low muscle mass (19), a body composition

42 phenotype (20) that is often observed in patients with cancer, regardless of body size and  
43 adiposity (21, 22). The presence of low muscle mass is independently associated with negative  
44 clinical outcomes in cancer including greater risk for treatment toxicity and decreased survival  
45 (21-23). Changes to dietary choices that result in inadequate protein intake cause a depletion of  
46 amino acid reserves and compound the negative impact to skeletal muscle (24, 25). Despite the  
47 prevalence of malnutrition (and low muscle mass) and associated negative clinical outcomes,  
48 oncology patients underestimate the presence of these conditions (26). Many patients alter their  
49 diet in attempt to cure the cancer or alleviate symptoms (27) but may not consider the impact of  
50 dietary choices on muscle health.

51 Without a focus on optimal nutrition, extreme diets may result in malnutrition which in turn will  
52 delay or interfere with delivery of standard of care cancer treatments. Optimal nutrition is  
53 essential for preventing or halting malnutrition and related muscle loss in cancer (5, 28, 29).  
54 Adequate nutritional status can also improve treatment tolerability, in turn decreasing symptom  
55 burden, improving quality of life and overall health (30). As five-year cancer survival rates  
56 increase—as high as 98% in some types of cancer (31)—it is important for patients and  
57 clinicians to look beyond the disease itself and recognize the importance of nutrition for  
58 improving subjective wellbeing, physical function, and other clinical outcomes over the long  
59 term (11). Optimal nutritional status is highly influenced by dietary choices rendering the topic  
60 an important consideration for nutritionally vulnerable populations.

61

62 *Determinants of Dietary Choice*

63 Dietary choices are determined by several complex factors. For brevity and clarity, determinants  
64 of dietary choice have been broadly divided into internal (e.g., biological, psychological) and  
65 external (e.g., economic, social, physical environments) factors (32-34), **Figure 2**. Non-  
66 exhaustive examples of internal factors that are primarily biological in nature include hunger,  
67 satiety, taste, energy balance, and genetics whereas psychological factors may include attitudes,  
68 beliefs, and knowledge. External factors are diverse and can include socio-economic status, cost,  
69 marketing, and policy (economic environment); friends, family, peers (social environment); and  
70 home, work/school, and access to food procurement (physical environment) (32, 33). The  
71 influence of external factors on food choice can be partially self-controlled (e.g., through  
72 changes to social environment) although the omnipresence of certain factors (e.g., physical and  
73 cultural environments) are less controllable (32). Understanding the determinants of dietary  
74 choice is therefore important in designing targeted strategies to improve nutritional status.

75

### 76 *Determinants of Dietary Choice Specific to Cancer*

77 Cancer and corresponding treatments can further impact dietary choices as summarized in  
78 **Figure 3**. In many instances, cancer and anti-cancer treatments alter stable conditions within the  
79 body (e.g., muscle protein turnover) (35, 36) which can lead to changes in the amount and  
80 quantity of dietary intake (32). For example, cancer or cancer treatments may alter resting or  
81 total energy expenditure through changes in body composition, tumor burden, systemic  
82 inflammation, or physical activity (37-40). Free-living total energy expenditure determines  
83 energy requirements and may therefore indirectly impact dietary choices. Central and peripheral  
84 appetite signals (e.g., agouti-related peptide; ghrelin (41)) and nutrition impact symptoms (e.g.,

85 pain, nausea) are often altered by cancer and treatments and are strong determinants of dietary  
86 intake, which in many cases is a subsidiary of dietary choice (37).

87 Given the dynamic nature of cancer and its treatments, select factors that influence dietary  
88 choices can be transient (e.g., nutrition impact symptoms) and result in varied dietary intake (42,  
89 43). Symptoms such as fatigue, neuropathy, nausea, anorexia, and taste alterations are common  
90 (44) and can lead to altered dietary choices and subsequently impaired nutrient intake (43).

91 Symptoms from cancer and its treatment may also alter environmental determinants of dietary  
92 choice including the ability to purchase, prepare, and consume foods (45). Factors such as taste  
93 preferences, nutrition knowledge, socio-economic status, geography, culture, and traditions also  
94 influence dietary choices for all populations (42, 43, 46-48) but may be further affected by the  
95 disease. For example, taste can be impacted by anti-cancer treatment; patients living in remote  
96 areas may have to travel to urban centers for treatment, changing their physical environment and,  
97 consequently, their dietary choices; and the ability to continue traditions may be affected by  
98 treatment side effects. In addition to dietary implications, the psychological impact of a cancer  
99 diagnosis can motivate patients to make positive lifestyle changes (49). As a result, some people  
100 with cancer may initiate behavioral modifications that impact dietary choices with the goal of  
101 positive dietary change and a commitment to improve health (6).

102 Evidence-based nutrition practices can optimize quality of life in this vulnerable population, and  
103 positively impact overall health (1-3, 30). Most patients are motivated and seek nutrition  
104 information to educate themselves to make informed dietary choices (7). Common sources of  
105 nutrition information include physicians, family/friends, and mass media (7). Non-evidence  
106 based guidance on nutrition and cancer—readily available online—may influence dietary change  
107 (8). One-third of cancer-related social media articles contain misinformation and of those, nearly

108 80% contain harmful information (9). Financial incentives are also prevalent in online cancer  
109 nutrition information and much of the content contains prevention, treatment, or curative content  
110 claims (50). Patients are thus likely to face conflicting information from various sources and may  
111 in turn acquire nutrition-related fallacies that self-guide dietary choices (51). Although evidence-  
112 informed nutrition is viewed as important by many patients, more than half do not discuss  
113 nutrition with a health care professional at any point during cancer trajectory (52).

114 The emotional and psychological impact of a cancer diagnosis can manifest into motivation for  
115 lifestyle change (49). Dietary choices and subsequent food intake are a component of wellbeing  
116 that offer patients with cancer the opportunity to regain a sense of control over their bodies and  
117 health, which can motivate positive dietary change (49, 53). In a qualitative study of females  
118 (n=36) with a history of cancer (primarily breast), the diagnosis instilled feelings of vulnerability  
119 which led patients to take ownership of their health, capitalize on their “second chance”, and  
120 improve dietary choices to elevate overall health and quality of life (54). Females acknowledged  
121 the interconnection between the psychological impact of a diagnosis and regaining control of  
122 their health through modifiable lifestyle factors including dietary choice (54). Similarly, the  
123 importance of nutrition at all time points throughout the cancer journey and a feeling of control  
124 over diet and nutrition also emerged from a mixed-methods study of patients with varying cancer  
125 types (52). The association of cancer with other chronic conditions, the threat of diminished  
126 physical capabilities and quality of life, and the risk of disease recurrence are additional reasons  
127 that many patients attempt to positively alter lifestyle habits when living with cancer (6).

128 Beyond the psychological impact of a cancer diagnosis, sex differences are also apparent in  
129 dietary choice in patients with cancer (27, 55-57). Males have shown to be less likely to alter  
130 their nutritional intake following a cancer diagnosis compared to females (OR: 0.749; 95% CI:



131 0.597–0.940;  $p=0.013$ ) (58). Males who do make dietary changes post-diagnosis are more likely  
132 to base food choices on gratification factors such as taste preference compared with health-  
133 related factors (59). It is possible that males tend to not engage in active nutrition-focused  
134 information seeking behaviors compared to females (59). Compared to males, females have  
135 stronger beliefs in healthy eating (55) and engage in active nutrition information seeking,  
136 suggesting that they may be more likely to make dietary changes in light of a health condition  
137 (59). It is also possible that sex differences in beliefs about healthy eating likely stem from  
138 historical societal- and gendered-norms whereby females are more health conscious and apt to  
139 alter their dietary choices to follow nutritional guidelines and improve health (59). While  
140 literature on dietary change in cancer types where the incidence is more (or only) prevalent in  
141 males is sparse (57), the limited available evidence suggests that males may benefit from more  
142 active and specialized nutrition-focused health promotion (i.e., enabling improved control over  
143 health).

#### 144 *Changes to Dietary Choices Post-Diagnosis*

145 Data on dietary change amongst cancer patients are summarized in **Figure 4**. Literature has  
146 focused primarily on breast cancer (57), likely due to public and patient research funding  
147 priorities as well as the high prevalence and mortality of this cancer type (60). A cross-sectional  
148 online survey of breast cancer survivors ( $n=315$ ) found that patients with body weight in a  
149 healthy range, a higher level of education, and  $\geq 5$  years post diagnosis were more likely to report  
150 positive dietary changes (61). The four main areas of reported change made by over half of  
151 survivors surveyed included increased intake of fruit and vegetables or decreased red or  
152 processed meat, high calorie sweets, and fried food consumption (61). Similarly, a study of  
153 Australian and Finnish females ( $n=354$ ) attending breast cancer clinics found that one-third of

154 patients reported post-diagnosis dietary changes that included increased consumption of fruits  
155 and vegetables and decreased consumption of red meat, animal fat, and sugar (27). These dietary  
156 changes were associated with patient characteristics such as younger age, increased education,  
157 and a longer time since diagnosis (27). Time since diagnosis was not considered for inclusion in  
158 this study, although the odds of dietary changes made since diagnosis were greater for patients  
159 diagnosed over 5 years prior (OR: 2.28; 95% CI: 1.20–4.30; p=0.011) (27). A survey of patients  
160 with invasive breast cancer (n=684) found that most commonly reported changes to dietary  
161 intake within two years of diagnosis included increased consumption of fruits, vegetables,  
162 pulses, nuts, and wholegrains (62). Patients also reported decreased consumption of red and  
163 processed meat, animal fats, refined grains, and baked goods (62). Of the patients who reported  
164 changes to their red and processed meat intake, 11% and 17%, respectively, eliminated those  
165 products from their diet (62). Dietary changes post-diagnosis resulting in decreased protein  
166 intake have also been observed in patients with stages I-II invasive breast cancer (63). The  
167 largest study to date to assess dietary change of patients with cancer was a prospective cohort of  
168 patients (n=1560) in the United Kingdom being treated for breast cancer (64). They used food  
169 frequency questionnaires to assess dietary changes from pre- to post-diagnosis and found that  
170 overall caloric intake and energy-adjusted macronutrient consumption decreased while fibre  
171 intake increased (all p<0.0001) (64). Overall, many of the dietary changes reported by females  
172 with breast cancer aligned with recommendations for cancer prevention (65) but were initiated  
173 post-diagnosis and post-treatment.

174 Males with prostate cancer are a group interested in dietary changes following a diagnosis,  
175 especially those under surveillance (i.e., not receiving systemic therapy) (66). A prospective  
176 cohort study of community-dwelling males in the United Kingdom being tested for prostate

177 cancer (n=3935) used a food frequency questionnaire to assess dietary intake prior to diagnosis  
178 (66). Males who developed prostate cancer (n=678) repeated the same food frequency  
179 questionnaire one year post-diagnosis to assess dietary change (66). Within the year before  
180 diagnosis, one third of patients adopted healthier dietary habits including increased consumption  
181 of fruit and vegetables juices, tomatoes and tomato products, and protein, (66). Increased protein  
182 intake (from all sources) was observed in 40% of patients although the difference in mean intake  
183 was negligible (1.5 g/day) compared to males (13.4%) who decreased protein intake post-  
184 diagnosis (mean difference: -18.4 g/day; p<0.0001) (66).

185 Another cancer type in which dietary changes have been assessed is colorectal cancer—one of  
186 the most common cancer types globally (60). A longitudinal study of patients in the Netherlands  
187 with stage I-III colorectal cancer (n=1072; 63% male) quantified modifications to dietary and  
188 physical activity patterns at time of diagnosis, 6 months, and 2 years post-diagnosis using an  
189 overall lifestyle score based on World Cancer Research Fund/American Institute for Cancer  
190 Research recommendations for cancer prevention (67). Two years following diagnosis, mean  
191 lifestyle score suggested that only marginal changes were made since time of diagnosis (67).  
192 Specifically, survivors decreased their intake of sugary drinks (-45 g/day) and red and processed  
193 meat (-62 g/week) but made no changes to their fruit and vegetable, alcohol, or ultra-processed  
194 foods intake compared to time of diagnosis, suggesting that nutrition-focused support tools for  
195 patients were warranted (67).

196 An American study of mixed cancer types used telephone interviews to assess dietary changes in  
197 patients (n=356) diagnosed with breast, prostate, or colorectal cancers within the two years prior  
198 to being surveyed and found that 40% of patients reported at least one dietary change within the  
199 prior year (56). Patient characteristics such as younger age, >13 years of education, and a

200 diagnosis more than a year prior to the interview all independently increased the likelihood of  
201 reported dietary change (56). The most prevalent dietary change reported was increased intake of  
202 fruits and vegetables (n=272; 76.4%), followed by less red meat (n=69; 19.4%) and fat (n=77;  
203 21.6%) intakes (56). Within the year prior to the interview, 48% of patients had begun taking  
204 dietary supplements (i.e., vitamins, minerals, and/or herbals), a change that was more common in  
205 females (adjusted OR: 2.19; p<0.001) and patients less than 60 years of age (adjusted OR for 60–  
206 69 years: 0.42; p<0.001) (56). Similar dietary changes were observed in a study of Italian cancer  
207 survivors (n=170) with various malignancies (65% breast cancer) who completed an online  
208 survey ≥6 months after treatment completion (68). Post-diagnosis, 36% of patients initiated  
209 dietary changes (68) that may have impacted their quality of protein intake, although the  
210 resulting impact on total dietary protein intake could not be determined. For example, patients  
211 reported increased consumption of pulses, nuts/seeds, and fish and decreased consumption of red  
212 and processed meat and dairy (68). An Italian study of patients (n=1257) with mixed cancer  
213 types who were receiving anti-cancer treatment found that 56% of patients reported making  
214 changes to intake from major food groups (58). Changes to food and beverage intake included  
215 decreased red and processed meat, alcohol, and sugary drink intake, which are consistent with  
216 recommendations for cancer prevention (58, 65). Notably, 61% of those surveyed reported  
217 decreased consumption of milk products since diagnosis (58). Among the several types of  
218 cancers surveyed, those diagnosed with breast, prostate, or colorectal, cancers were the most  
219 likely to alter their diet (58). A Dutch study showed that people with mixed cancer types (n=239)  
220 reported decreased meat intake and increased intake of plant-based foods following a cancer  
221 diagnosis (69). A study of the NutriNet-Santé cohort (n=696) of mixed cancer types found that  
222 post-diagnosis changes included decreased vegetable, dairy, meat, soy, and alcohol consumption

223 which cumulatively resulted in significantly lower total protein intake (-17.4±12.5 g/day;  
224 p<0.0001), compared with pre-diagnosis (70).

225 Amongst studies reviewed herein, changes to protein intake were frequently observed, **Figure 4**.  
226 Increased post-diagnosis protein intake represent dietary choices in line with oncology nutrition  
227 guidelines (3, 66). In contrast, if appropriate substitutions are not made for decreased  
228 consumption of specific proteins (i.e., meats, milk products), this may result in decreased protein  
229 intake which would not align with oncology nutrition guidelines (3, 58). Notably, these  
230 guidelines were developed for healthcare providers who are caring for patients receiving active  
231 cancer treatment and are not tantamount to guidelines for cancer prevention, **Figure 5** (71). For  
232 example, red and processed meat are more commonly considered to be associated with colorectal  
233 cancer development although these foods may be associated with improved survival in patients  
234 with active cancer (72). A prospective cohort study of 992 patients with stage III CRC found that  
235 low intake of red and processed meat post-diagnosis was associated with an increased risk of  
236 death (HR quartile 1 vs quartile 4: 1.72; 95% CI: 1.15-2.58) (72). Changes to dietary choices that  
237 do not align with oncology nutrition guidelines may be based on misunderstandings of the  
238 relationship between specific foods or nutrients and health conditions (e.g., cancer) and may put  
239 patients at risk for malnutrition, muscle loss, and adverse outcomes, **Figure 5**. Muscle health is  
240 an important consideration for patients with cancer. Beyond adequate energy and protein that is  
241 required to mitigate muscle loss, patient education on the importance of muscle is needed.

242

243 *The Effect of Nutrition Knowledge on Dietary Choices*

244 Nutrition knowledge and information are major determinants of dietary choices and overall  
245 nutrient intake (46). This area of research is both new and complex as nutrition knowledge is  
246 mediated by multiple factors, including age, sex, health literacy, cultural influences,  
247 socioeconomic status, and physical environment (46, 73). Research on nutrition knowledge and  
248 dietary choices has largely been limited to general and athletic populations. In fact, a systematic  
249 review of the relationship between nutrition knowledge and dietary intake across all populations  
250 demonstrated the dearth of research in this area which precluded a meta-analysis of results (46),  
251 none of which investigated nutrition knowledge among patients with cancer (46).

252 Though nutrition knowledge is an integral component of health literacy, its effect on nutritional  
253 practices is complex and poorly understood (46, 74). One study of healthy adults (n=376) found  
254 that health literacy was a predictor ( $R^2=0.24$ ;  $p<0.01$ ) of diet quality (i.e., healthy eating index  
255 score) (75) although similar studies in diverse populations are needed to confirm findings. The  
256 integral connection between nutrition knowledge and health literacy is related to the connection  
257 between diet choices and many non-communicable chronic conditions (46). For example,  
258 decreased health literacy is associated with increased prevalence and poorer management of  
259 several chronic conditions in addition to increased healthcare costs (46, 76, 77). Lower health  
260 literacy leads to poor health outcomes and is associated with a lower response to health  
261 education (46, 78). Thus, health literacy should inform community nutrition education resources  
262 and teaching materials to promote equitable health-related knowledge. Ultimately, people with  
263 greater health literacy are better prepared to make informed healthcare decisions (46).

264 The diagnosis of cancer may be a ‘teachable moment’ to make positive health behavior changes  
265 and presents an opportunity for healthcare professionals to provide nutrition-related health  
266 promotion education, **Figure 6**. Appraising the relationship between nutrition knowledge and

267 dietary choices in individuals with cancer is essential to capitalize on the ‘teachable moment’  
268 that often accompanies a diagnosis of cancer and subsequent treatment (6). It is possible that the  
269 motivation to adopt a healthier lifestyle post-cancer diagnosis may enhance the effect of nutrition  
270 knowledge on dietary choices as they are inundated with conflicting nutrition information in  
271 mass media, particularly online (46, 57). An online survey of cancer survivors (n=170) in Ireland  
272 who were primarily female with a history of breast cancer found that patients wanted to expand  
273 their knowledge of nutrition during their treatment, especially pertaining to diet as a therapy to  
274 alleviate treatment-related symptoms (e.g., constipation, nausea, decreased appetite, etc.) (68).  
275 Despite interest in nutrition, 80% of the patients surveyed were not provided the opportunity for  
276 a registered dietitian/nutritionist consultation during treatment (68). In sum, many patients may  
277 be motivated to make positive changes to their diet, which may include increasing nutrition-  
278 related knowledge.

279

### 280 *Information Needs of Patients with Cancer*

281 It is important for patients across the cancer continuum to have access to credible, trustworthy,  
282 and user-friendly sources of nutrition information to guide dietary choices because a cancer  
283 diagnosis may enhance information-seeking and subsequent lifestyle changes. Patients with  
284 cancer—particularly those diagnosed at a younger age—are a group with high demands for  
285 nutrition information (62, 79-81). An online survey investigated nutrition information needs of  
286 young patients in the United States and Canada with a history of cancer (n=217) and  
287 demonstrated that 89% identified a need for diet and nutrition information while 46% reported  
288 information needs were unmet (79).

289 To fulfill information needs, patients with cancer gravitate towards the internet but feel that more  
290 information should be available through their treating institution (58, 68, 81). An Italian study  
291 surveyed patients with cancer and found that 92% (n=1146) would prefer to receive more  
292 nutrition-related advice from their medical team during cancer treatment (58). In Ireland, 39% of  
293 cancer survivors (n=1073) saw a registered dietitian and 57% of those who did not see a  
294 registered dietitian wanted access to credible nutrition support, suggesting that their information  
295 needs were unmet (81). In a separate cohort of Irish breast cancer survivors (n=170), only 20%  
296 reported seeing a registered dietitian/nutritionist during their cancer treatment (68). In the  
297 absence of adequate information, patients may be more likely to seek unregulated or incorrect  
298 sources of information that may not provide credible recommendations. Given that a cancer  
299 diagnosis appears to be a teachable moment for patients, nutrition education that empowers  
300 patients to better detect credible sources of information could be integrated into care plans (82).

301

### 302 *Sources of Nutrition Information in Cancer*

303 Patients with cancer are susceptible to nutrition misinformation (9), leading to barriers to  
304 adhering to nutrition interventions and sub-optimal dietary choices, collectively contributing  
305 negatively to overall nutritional status (58, 61, 67, 71). Credible sources of nutrition information  
306 are diluted in the abundance of nutrition misinformation available on the internet, making it  
307 challenging for patients with cancer to determine which sources of information should guide  
308 dietary choices (8, 57, 83, 84). While internet search engines and social media platforms can  
309 offer reliable sources of information, people engage more with nutrition-related misinformation  
310 than credible sources (9, 85). One study found that accuracy of information was negatively  
311 correlated with viewer engagement of prostate cancer information videos (85). Most credible



312 information available online or through smartphone applications target healthcare professionals  
313 as opposed to patients and their families (86).

314 Despite the dubious credibility of internet-based nutrition information, patients seeking material  
315 related to cancer often consult the internet before their physician (57, 62, 87). Many patients  
316 experience an overall sense of lack of available nutrition information from their cancer care  
317 providers (68). An American national survey of patients with mixed cancer types (n=2419) found  
318 that diet was addressed during oncology visits in 50.1% of patients (88). Patients who received  
319 diet recommendations from their oncology provider were more likely to make dietary changes  
320 compared with patients who did not receive advice (81.1% vs. 71.3%;  $p < 0.001$ ) (88). For many  
321 patients, access to a registered dietitian/nutritionist in the oncology setting is only possible once a  
322 state of malnutrition is reached or significant nutritional risk is identified (89). In some settings,  
323 nutritional assessment is only incorporated into oncologic care if requested by the patient (90). In  
324 turn, many patients rely on their own online and social media-based research (68). An  
325 exploratory global survey of breast cancer survivors (n=315) found that less than half turned to  
326 their health care provider for nutritional advice but that 75% relied on internet searches (e.g.,  
327 Google) as their primary source of nutrition information (61). Additionally, 40% of respondents  
328 sought nutritional advice from social media platforms including Twitter and Facebook (61).

329 Notably, the credibility of information sources selected from search engines and social media  
330 outlets were not assessed (61). Similarly, in a group of Italian breast cancer survivors (n=684),  
331 the most common source of information used to guide dietary choices post-diagnosis was  
332 internet research conducted by the patient (62). This information-seeking behaviour was more  
333 common in patients under the age of 65 years but all patients, regardless of age, indicated a  
334 tendency towards implementing dietary changes without informing their oncologist (62). In line

335 with these findings, a small Canadian study found that only 9% of medical oncologists surveyed  
336 (n=57) reported being asked about the ketogenic diet by patients, despite widespread popularity  
337 of online information about sugar and cancer (91).

338 For many, the internet and social media platforms are ubiquitous sources of information that are  
339 often used to inform health decisions (61, 92) and are recognized for their high impact and broad  
340 reach in health education, health monitoring and support of health behaviors (93). Although the  
341 internet—including social media platforms—is likely the primary source of nutrition information  
342 for patients, the effect of this type of information acquisition on dietary choices remains widely  
343 unknown (57, 58, 61).

344

#### 345 *Relevance to Clinical Practice*

346 Many patients with cancer value the importance of optimal nutrition for health and are motivated  
347 to make dietary changes (56, 80). This scenario offers a unique window of opportunity for  
348 registered dietitians/nutritionists and other health practitioners to provide patients with evidence-  
349 based nutrition information. Guidelines and credible information are sparse, but available for  
350 health care providers (3, 94, 95) and for patients (96). However, practical and effective nutrition  
351 education must consider known barriers to dietary change, patients who require personalized  
352 nutrition intervention versus those who may benefit from other formats of education (e.g., group  
353 sessions, evidence-based resources), and the availability of resources within the health system.  
354 Characterizing dietary choices, nutrition knowledge, information needs, and sources of  
355 information in patients with cancer can inform effective nutritional interventions and may lead to  
356 a better understanding of gaps in the literature that are preventing an improved characterization

357 of drivers of cancer prevention and control. Further, this has the potential to personalize  
358 recommendations in the context of current intake and nutrition goals throughout cancer  
359 survivorship, ultimately contributing towards maintaining or improving health, quality of life,  
360 and clinical outcomes.

361

### 362 *Conclusion*

363 Regardless of the type of malignancy, cancer appears to be a motivating reason for many patients  
364 to alter their dietary choices. Most reported changes align with recommendations for cancer  
365 prevention but are implemented post-diagnosis. Importantly, dietary recommendations for cancer  
366 treatment may differ from recommendations for prevention. Reported changes may not align  
367 with post-diagnosis oncology nutrition recommendations and could put patients at risk of  
368 malnutrition and/or muscle loss. At the time of diagnosis, during treatment, and post-treatment  
369 are opportunistic times for patients to gain knowledge of nutrition and implement positive  
370 dietary changes. In the era of mass media, increasing availability of nutrition misinformation  
371 poses a challenge to accessing trustworthy sources. Informed dietary choices improve nutritional  
372 status and positively impact overall health; however, little is known about the determinants of  
373 dietary choices and patterns in patients with a recent diagnosis of specific cancer types and in  
374 patients in North America. Given the heterogeneity of cancer-driven determinants of dietary  
375 choices, further research is needed to better inform nutrition-related health promotion materials  
376 and assist health care providers with determining best-practices approaches for widespread  
377 dissemination of these materials.

378

379 Figure Captions:

380 Figure 1. Causes and consequences of nutritional vulnerability after a cancer diagnosis. Optimal  
381 nutrition is critical to prevent or halt malnutrition and muscle loss, and to mitigate risk of adverse  
382 outcomes.

383 Figure 2. Overall determinants of dietary choices.

384 Figure 3. Drivers of dietary decision making in cancer.

385 Figure 4. Common dietary changes among patients with cancer following a diagnosis.

386 Figure 5. Discrepancies between optimal (i.e., recommended) dietary changes during active  
387 cancer and actual changes reported by patients post-cancer diagnosis.

388 Figure 6. Opportunistic time for increasing nutrition knowledge in patients with cancer. After a  
389 cancer diagnosis, patients feel motivated to make lifestyle changes to address potential side  
390 effects of cancer and its treatment and improve their own health. This might be a ‘teachable  
391 moment’ for dietitians and health professionals to educate patients and provide them with  
392 credible sources of nutrition information. Because of this a new area of research, it remains  
393 unknown whether increasing nutrition knowledge would result in healthier dietary choices by  
394 patients with cancer.

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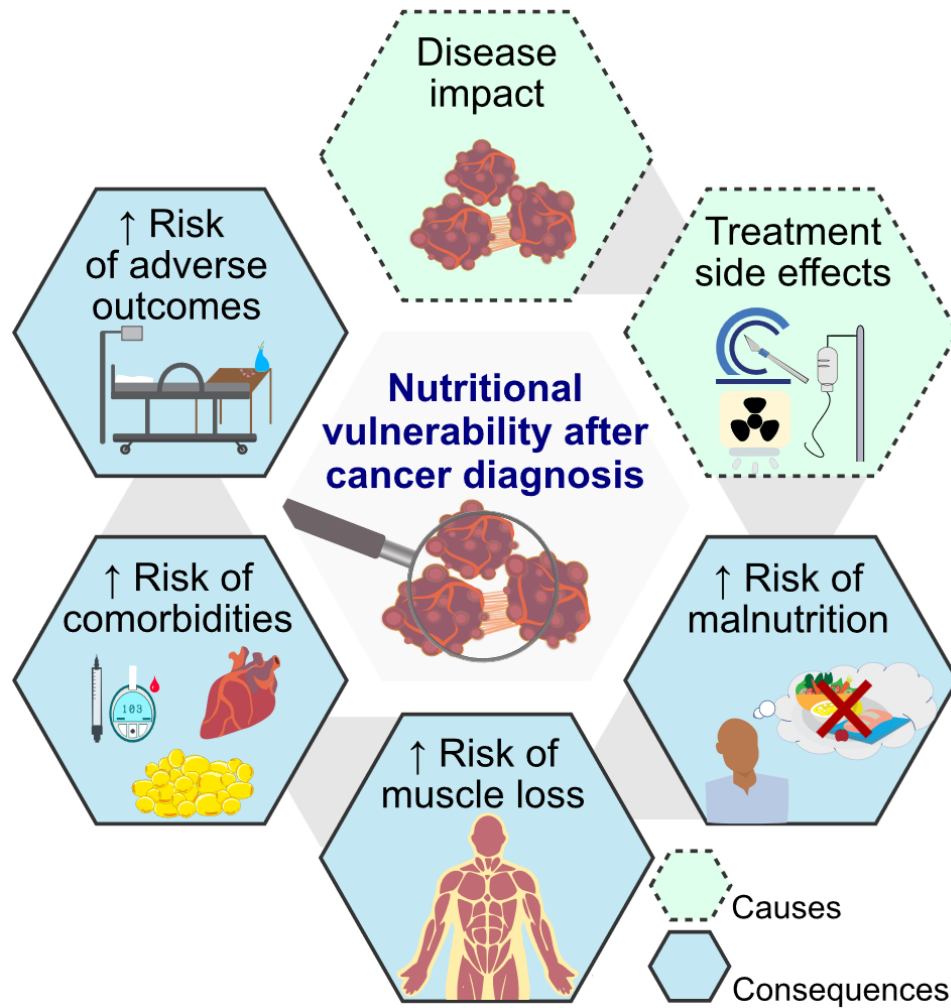
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**Figure 1.** Causes and consequences of nutritional vulnerability after a cancer diagnosis. Optimal nutrition is critical to prevent or halt malnutrition and muscle loss, and to mitigate risk of adverse outcomes.

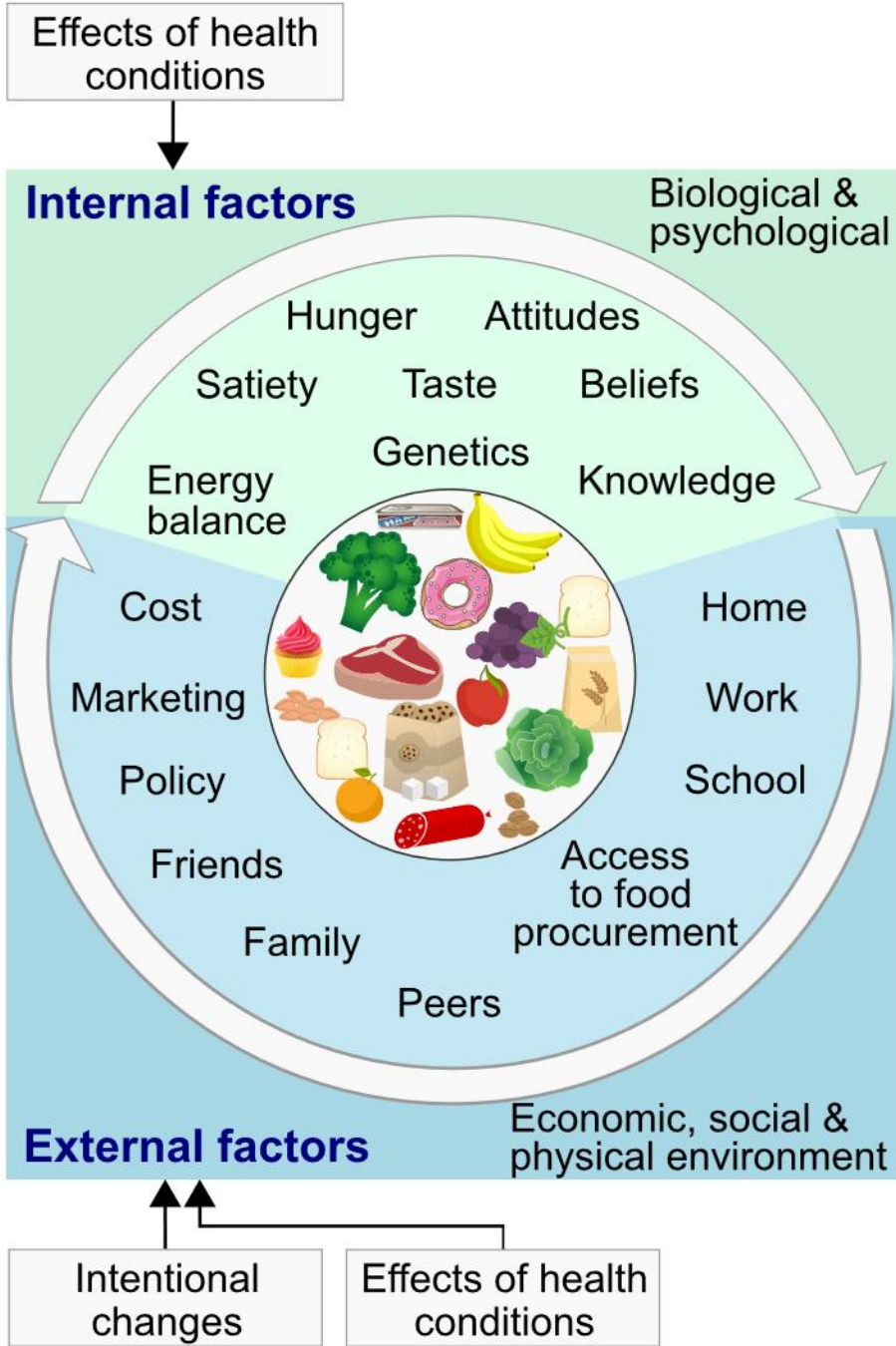
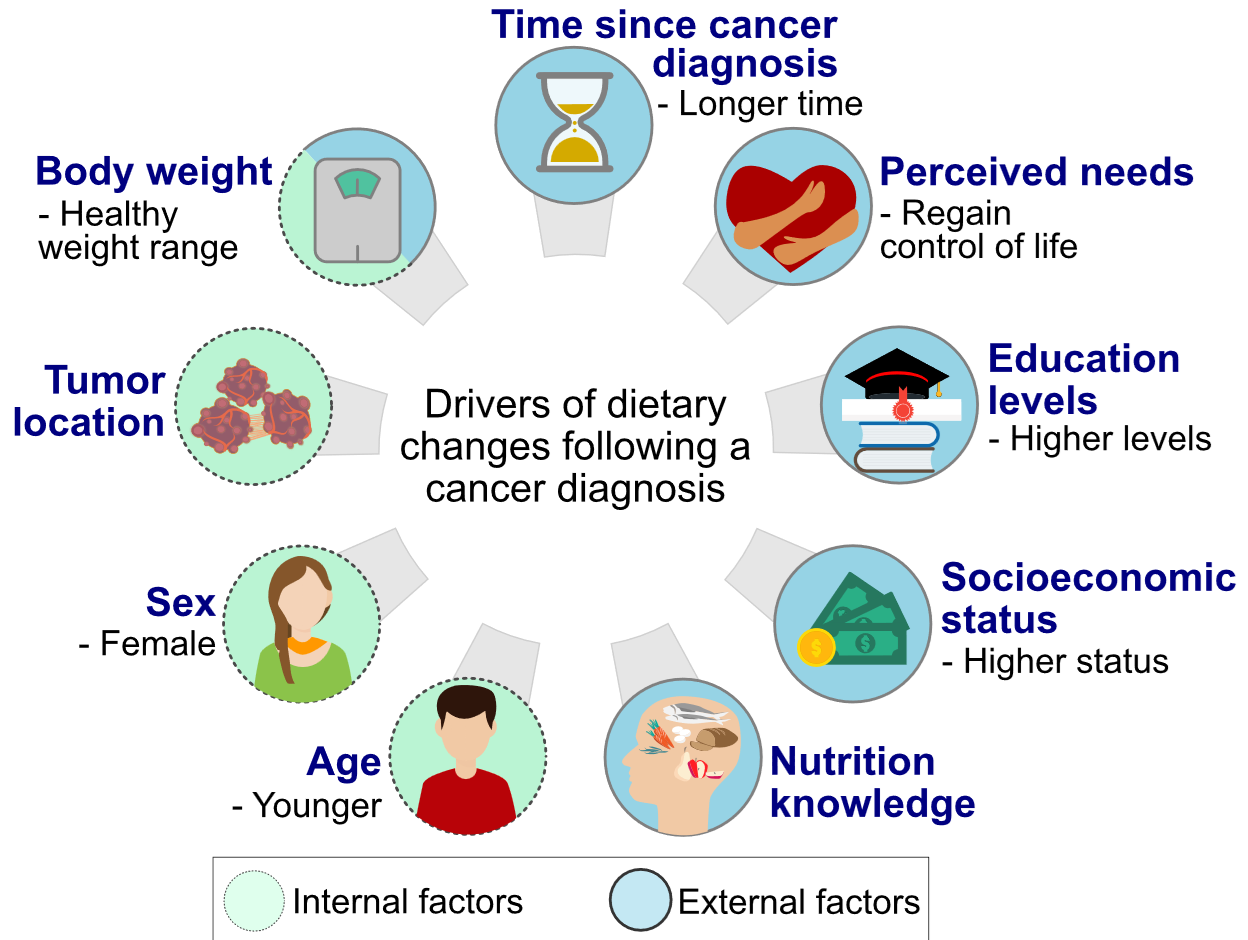
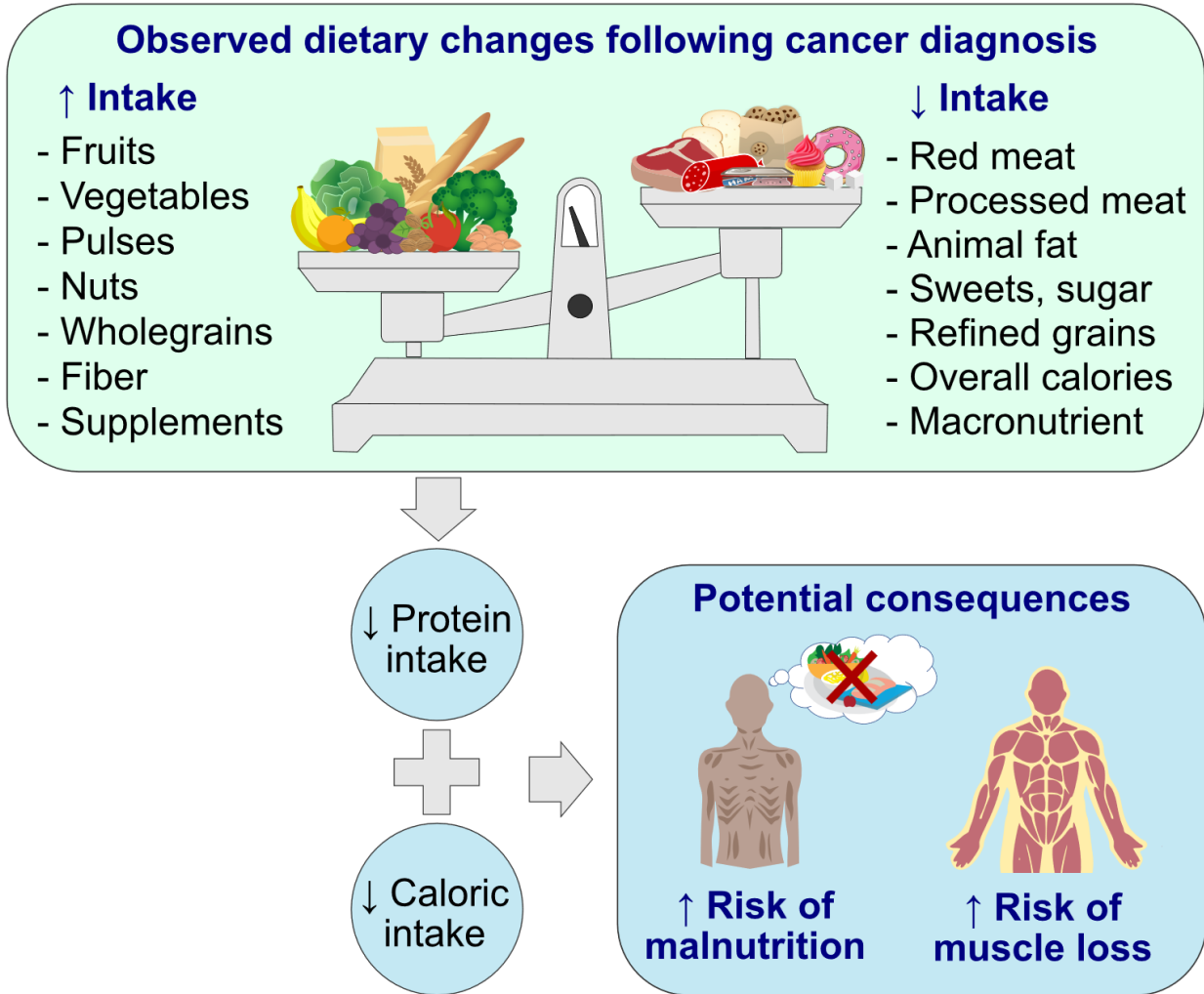


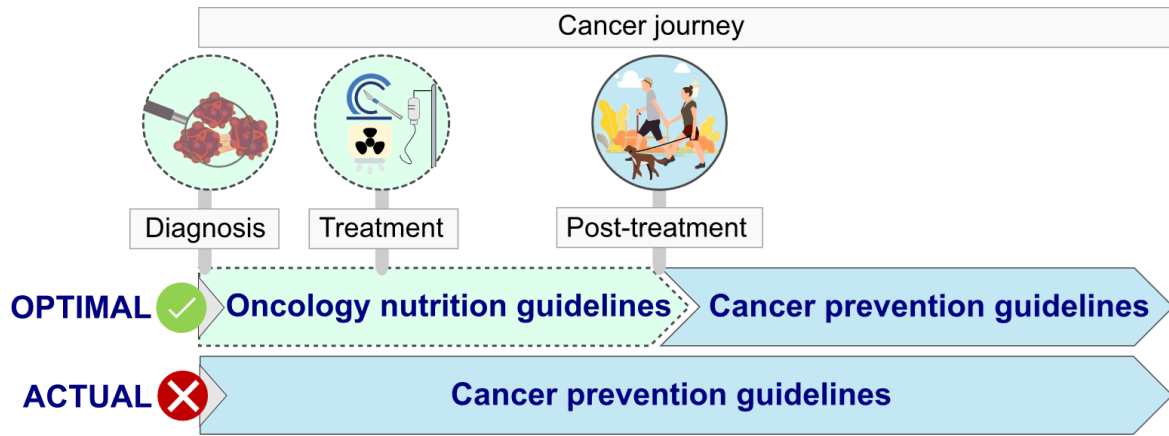
Figure 2. Overall determinants of dietary choices.



**Figure 3.** Drivers of dietary decision making in cancer.



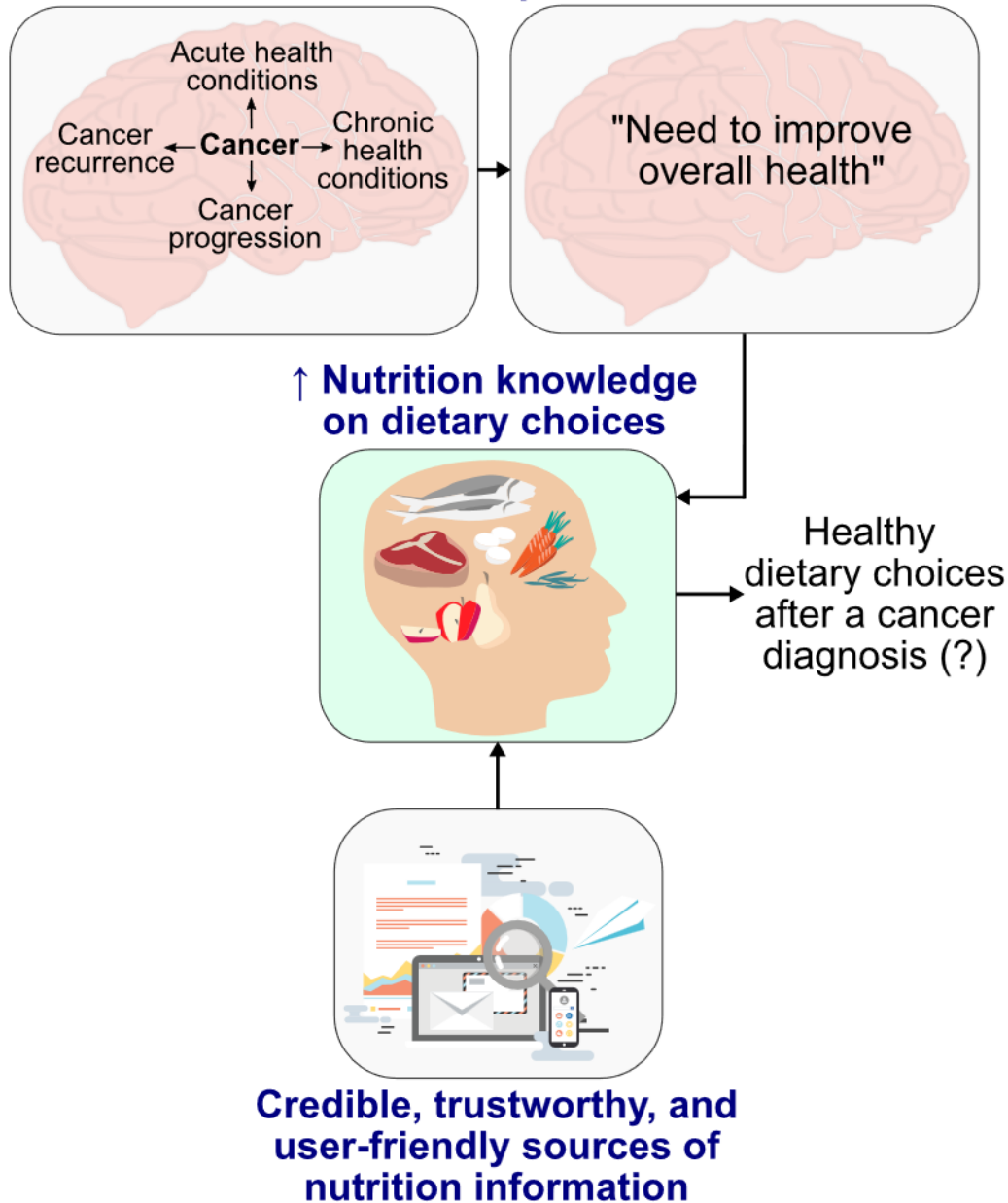
**Figure 4.** Common dietary changes among patients with cancer following a diagnosis.



**Figure 5.** Discrepancies between optimal (i.e., recommended) dietary changes during active cancer and actual changes reported by patients post-cancer diagnosis.



## 'Teachable moment': nutrition-related health promotion education



**Figure 6.** Opportunistic time for increasing nutrition knowledge in patients with cancer. After a cancer diagnosis, patients feel motivated to make lifestyle changes to address potential side effects of cancer and its treatment and improve their own health. This might be a ‘teachable moment’ for dietitians and health professionals to educate patients and provide them with credible sources of nutrition information. Because of this a new area of research, it remains unknown whether increasing nutrition knowledge would result in healthier dietary choices by patients with cancer.