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The Creation Of An Algorithm To Assist Survivorship Clinics Identify The Rehabilitation Needs Of Cancer Survivors: An Administrative Case Report

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2 **The Creation of an Algorithm to Assist Survivorship**
3 **Clinics Identify the Rehabilitation Needs of Cancer**
4 **Survivors: An Administrative Case Report**

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8
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13
14 The author has completed the HIPAA certification course and is compliant with university
15 requirements regarding the disclosure of PHI.

16
17 Keywords: survivorship clinic, algorithm, cancer, screening, rehabilitation

18 **Abstract**

19 **Background and Purpose:** Approximately 40% of cancer survivors have unmet
20 rehabilitation needs. Cancer survivors not receiving rehabilitation care may be due to
21 survivorship clinics struggling to identify which of their survivors are appropriate for
22 rehabilitation. The purpose of this case report was to review the literature and create an
23 algorithm that could assist survivorship clinics with rehabilitation referrals.

24 **Case Description:** A survivorship clinic in Maine was attempting to address the lack of a
25 rehabilitation screening process. A survey done by the clinic showed that approximately 40%
26 of their survivors used rehabilitation services. To address this lack of a screening process, a
27 literature review was conducted in the summer of 2020 to identify common cancer
28 impairments that may necessitate rehabilitation services. From there, an algorithm was
29 created that contained screening measures to identify those impairments. The initial
30 algorithm consisted of the Pain Visual Analogue Scale, Fatigue Numerical Scale, and Short-
31 Form 36 health questionnaire.

32 **Outcomes:** The final algorithm consisted of two parts. First the oncologic clinician asks
33 themselves whether the survivor can exercise without medical supervision. The second is
34 associated with the scoring of the Short-Form 36. The results of these two parts determine
35 eligibility for referral to rehabilitation services. An expert in oncology rehabilitation vetted
36 the algorithm in the fall of 2020. Expert feedback resulted in the final algorithm creation.

37 **Discussion:** The stakeholders were unavailable to discuss an evaluation of the proposed
38 algorithm or implementation into the survivorship clinic due to the 2020 pandemic. With the
39 help of expert feedback, the final algorithm contributes to the growing body of literature
40 regarding screening for oncology rehabilitation referrals. Future research should be aimed at
41 the implementation of existing algorithms into clinics.

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Word Count: 3,390 words

Background and Purpose

An estimated five percent of new cancer cases will occur in individuals aged 19-39, or *adolescents and young adults* (AYA), in 2020.¹ It is estimated there will be 89,500 new cancer cases in the year 2020, with the most common being thyroid, breast, melanoma, skin, testes and others.¹ The five-year survival rate for AYAs in 1975 was approximately 70%, and was estimated to be 84.6% in 2020.¹

Physical impairments are the main reason why cancer survivors report poor physical health. Weaver et al² asked 1,822 adult cancer survivors (no median age given but all were over 18) to fill out the 10-item Patient-Reported Outcomes Measurement Information System[®] (PROMIS[®]) Global Health Scale (PROMIS[®] Global 10) to assess their health-related quality of life (HRQOL). The cancer categories were defined by site (i.e. breast, prostate, etc.) by the researchers. Time since diagnosis and treatments received (if any) were also reported.² Poor physical HRQOL was reported by 24.5% of survivors, whereas poor mental HRQOL was reported by 10.1% of survivors.² Please refer to Table 1 for a non-exhaustive list of common impairments seen in cancer survivors, and reasons they may be referred to rehabilitation.³

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Table 1. Common Impairments and Reasons to Refer to Oncology Rehabilitation³

Impairment Category Domain	Reasons for Referral to Rehabilitation
General Physical	Difficulty returning to premorbid activities Fatigue Joint pain Musculoskeletal pain Neuropathic pain Referred Pain Weakness Deconditioning
Specific Physical	Autonomic dysfunction Back pain Balance dysfunction Bowel dysfunction Cervical range-of-motion limitations Chemotherapy-induced peripheral neuropathy Chest/thoracic pain Cognitive impairment Compression neuropathy
Functional	Difficulty with ADLs (dressing/bathing, etc) * Difficulty with IADLs (chores/shopping, etc) ** Prosthetics Assistive devices (cane, reacher, etc) Adaptive equipment needs Durable medical equipment needs Home safety evaluation Workplace evaluation Driving evaluation

68 **Table 1.** The left column describes the common impairment domains seen in survivors. The right
 69 column lists various reasons in each domain a survivor may be referred to rehabilitation. *
 70 ADLs: Activities of Daily Living, ** IADLs: Instrumental Activities of Daily Living.³
 71

72 Cheville et al⁴ examined 163 subjects with metastatic breast cancer (with a mean age of
 73 56.2 years) and determined that 92% of the subjects had at least one physical impairment. Of
 74 the 530 impairments identified by the researchers, 469 (88%) impairments necessitated
 75 physical therapy (PT) and/or occupational therapy (OT) while only 21% received the rehab
 76 services needed.⁴

77 When cancer survivors are not referred to rehab services, they may have impairment
78 needs that are never met. Thoreson et al⁵ contacted cancer survivors and asked two questions
79 to ascertain the subjects' need for rehabilitation and whether rehabilitation services were
80 used. Of the 2,466 eligible individuals who were contacted, 1,325 questionnaires were
81 returned (yielding a return rate of 54%).⁵ The most common cancer diagnoses identified in
82 the respondents were as follows: breast, prostate, melanoma, non-Hodgkin lymphoma,
83 colorectal/anal, gynecological, and other.⁵ Based on the responses, researchers determined
84 63% of respondents would benefit from rehabilitative services, with PT the most frequently
85 reported service needed at 43%. The researchers concluded 40% of the respondents reported
86 unmet needs.⁵

87 With an increase in cancer survivorship, some oncologists may look to rehabilitation
88 services (PT, OT, and speech-language pathology [SLP]) to screen for and treat cancer-
89 related physical impairments.³ However, cancer survivors are not being referred to
90 rehabilitation services as often as they should be. This was demonstrated by the Thoreson et
91 al⁵ study which found 40% of cancer survivors had unmet rehabilitation needs. This could be
92 due to a lack of understanding and clarity in the field of cancer rehabilitation.³ Another
93 potential problem may be survivorship clinics struggling to select appropriate screening
94 assessments to identify impairments, as well as utilization of personnel who would assist
95 with referral to rehabilitation services.³

96 To address the problem of survivors not being appropriately referred, the goal of this
97 administrative case report was the creation of an algorithm that provided screening
98 assessments for the most common impairments seen in cancer survivors. The most common
99 impairments are discussed in detail in the Development of the Process section below. The
100 strategy to develop a successful outcome included: 1) a literature review to identify the most

101 common impairments, and 2) finding screening assessments that would help identify those
102 impairments. This case report is needed to improve the ability of survivorship clinics to
103 accurately and efficiently identify impairments that should be referred to rehabilitation
104 services. Stout et al⁶ created a similar screening algorithm for cancer survivors that identifies
105 five domains (cardiometabolic, environmental, oncologic, aging, and behavioral) to inform
106 healthcare providers on exercise referrals for survivors. The researchers also take the
107 survivors' level of complexity into account when deciding exercise referrals. While the
108 algorithm proposed by Stout et al⁶ was broader in its scope, the proposed algorithm for this
109 project focused solely on referrals to rehabilitation services.

110 The purpose of this case report was to review the literature to identify the most common
111 impairments seen in AYA cancer survivors and find the most appropriate and evidenced-
112 based screening measures for those impairments. From there, the next step was the creation
113 and implementation of an algorithm based on those screening measures to better assist a
114 survivorship clinic screen for impairments that necessitate referral to rehabilitation.

115
116 **Case description: Target Situation and Setting**

117 The author had consent from all participating parties for this administrative case report.
118 The target setting was a suburban outpatient oncology center in the northeast region of the
119 United States with a survivorship clinic for cancer survivors. The outpatient center and its
120 employees were affiliates of a large urban hospital and its health network. No data discussing
121 the size of the survivorship clinic, or how many survivors they treat annually, was available.
122 The survivorship clinic was staffed by healthcare professionals including an oncologist,
123 survivorship navigator (Donna Green, Personal Communication, September 21st, 2020),
124 general physician, oncology nurse, and an oncology social worker. One of the main focus of
125 the healthcare providers was to screen for late effects of cancer treatment.⁷ Late effects are

126 best described as side effects experienced by cancer survivors, usually after the completion of
127 cancer treatment.⁷ Healthcare providers take a holistic approach and help survivors cope with
128 any issues they may have resulting from their cancer diagnosis, which could range from
129 difficulty at work to education about a healthy lifestyle.⁸ While the oncology center treats
130 survivors at all ages, the main focus on this project was on the AYA survivorship clinic
131 program.

132 The main concern of the oncology center was they did not have adequate screening
133 services in place that would identify which of their patients may benefit from rehabilitation
134 services. The lack of a dedicated rehabilitation staff required the clinic to refer their patients
135 to a local, but separate, non-profit organization for integrative treatments such as massage or
136 acupuncture. The survivorship clinic had to refer their survivors to independent providers for
137 rehab services. Please reference Figure 1 for the services offered by the survivorship clinic
138 and the services for which they needed to refer to other locations.

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Figure 1. Services Offered by the Survivorship Clinic

Service	We Offer	Referral
Survivorship Care Plans	✓	
Survivorship Clinic	✓	
Mental Health Counseling (LCSW)	✓	
Psychiatric services	✓	
Social Work	✓	
Wellness programming		✓
Rehabilitation – PT, OT		✓
Speech-language therapy	✓	
Support Groups, Education		✓
Exercise		✓
Social work	✓	
Smoking cessation	✓	✓
Financial counseling	✓	✓
Sexuality counseling		
Family & Caregiver support		✓
Neurocognitive assessment	✓	
Nutrition	✓	
Spirituality		
Complementary Medicine	✓	✓
Specialty services – pulmonary, fertility	✓	✓
Cardio-oncology	✓	
Screening for recurrence	✓	✓
Screening for new cancers	✓	✓
Other		

151

152 **Figure 1.** The left column lists various healthcare services. The middle column lists the
 153 services offered by the survivorship clinic. The right column lists the services that the
 154 survivorship clinic has to make an outside referral for (Barbra Perry, Survivorship Clinic
 155 Manager, Email Communication, July 21st, 2020).
 156

157 Since the survivorship clinic did not have a screening process in place, some of their
 158 patients may not have been referred to rehabilitative services appropriately. Figure 2 provides
 159 the results of a survey regarding the services used by survivors at this clinic. The author is not
 160 aware of these results being published in an article or journal. It was most likely performed
 161 internally by a clinic staff member to gauge the services survivors were using.

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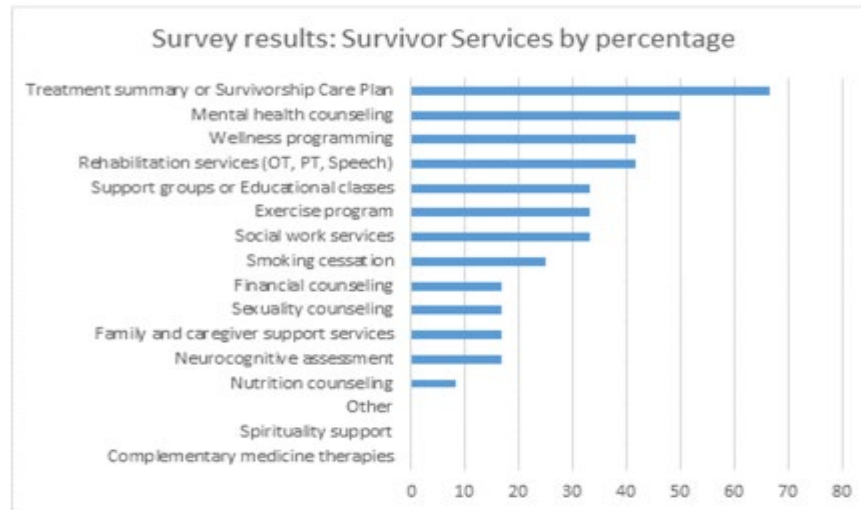
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Figure 2. Percentage of Services Used by Survivors



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168 **Figure 2.** On the left are the potential services available for a survivor at this survivorship
169 clinic. On the right is the percentage of survivors (sample size unavailable) who used the
170 service (Barbra Perry, Survivorship Clinic Manager, Email Communication, July 21st, 2020).
171

172 Approximately 40% of survivors at this survivorship clinic used rehabilitation services.

173 Thoreson et al⁵ surveyed cancer survivors who had one of the top ten most common cancer
174 diagnoses in Norway to ascertain rehabilitation needs. The researchers determined that 63%
175 of their cancer survivor subjects reported the need for at least one rehabilitation service.⁵

176 While one has to be cautious about comparing the results of one research study to this
177 specific survivorship clinic, it does illustrate the fact that this survivorship clinic may not
178 have been referring their patients to rehabilitation services at an appropriate rate.

179 The stakeholders reported there had been no previous management interventions to
180 ensure survivors are being referred to rehabilitation services when appropriately possible.

181 Regarding the stakeholder’s perspective, the use of the algorithm would hopefully
182 increase the number of survivors referred to rehabilitative services. With more survivors
183 getting their rehabilitation needs met, they are more likely to stay active. The World Cancer
184 Research Fund (WCRF) states moderate physical activity leads to a decrease in new

185 diagnoses of colon, breast (postmenopausal), and endometrial cancers.⁹ The WCRF also
186 states that physical inactivity may increase the risk of endometrium cancer.⁹ A survivor does
187 not want to go through a new cancer diagnosis, and by addressing their rehab needs, we help
188 to ensure they can be physically active.

189 Addressing the lack of adequate screening would hopefully increase the percentage of
190 survivors who use rehab services, therefore, potentially improving their physical health and
191 wellbeing. Rehabilitation interventions have been shown to be effective in improving the
192 functional needs of cancer survivors, whether treatment is completed or ongoing.¹⁰

193 The lack of screening processes within the survivorship clinic was an appropriate case
194 report because it was able to be addressed through a literature review that resulted in the
195 creation of an algorithm. The goal was to improve the ability to get cancer survivors
196 appropriately referred to rehabilitation services. The algorithm would hopefully function as a
197 means for the survivorship clinic to make referrals for rehabilitation services without needing
198 an actual PT on site. The creation of the algorithm was done by reviewing current literature
199 regarding the most common cancer impairments, and recommended screening assessments
200 based on current evidence regarding oncology rehab. Thus, the clinic could be confident the
201 algorithm was user-friendly, evidenced-based, and up-to-date.

202

203 **Development of the Process**

204 The algorithm required specificity to adequately capture all the survivors who needed
205 rehabilitative services. It also needed to be both time- and cost-efficient for it to be
206 implemented in the survivorship clinic. In order to achieve this, the development process
207 focused on reviewing the literature to identify the most commonly reported impairments seen
208 in survivors, as well as how to screen for those impairments with good clinical utility.

209 One of the most common impairments experienced by cancer survivors is pain. Van den
210 Beuken-van Everdingen et al¹¹ conducted a meta-analysis of 122 studies pertaining to cancer-
211 related pain. With a sample size of 63,533 survivors, roughly 66% reported pain with
212 metastatic or terminal cancer, while 39% reported pain after curative treatment and 55%
213 reported pain on anticancer treatment.¹¹ This study demonstrated the importance of an
214 algorithm to accurately measure pain and indicate a reason to refer to rehab.

215 Silver et al³ lists fatigue as one of the general physical impairments that might be a reason
216 to refer to rehabilitation. Stasi et al¹² performed a critical appraisal of the literature regarding
217 the prevalence and epidemiology of cancer-related fatigue. The researchers reviewed
218 multiple epidemiological studies regarding cancer related fatigue. With a subject population
219 of over 700 heterogenous cancer survivors between the various studies, the researchers
220 concluded fatigue is present in about 50% of survivors at the time of diagnosis.¹² They also
221 found 80-96% of survivors on chemotherapy report fatigue and 60-93% report fatigue during
222 radiation therapy.¹² This study highlights the importance of having a measure to screen for
223 fatigue in the algorithm.

224 The addition of an outcome measure that was broader in its scope would allow the
225 algorithm to screen for a wider variety of survivors. While the (PROMIS[®]) Global Health
226 Scale was mentioned previously, the Short-Form 36 (SF-36) was chosen as it is a
227 recommended functional assessment tool for assessing health status.³

228 Please refer to Table 2 for a list of screening measures included in the algorithm.

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Table 2. Screening Measures Selected with Rationale for Inclusion and Scoring Instructions

Screening Measures	Rationale for Inclusion	Scoring Instructions
Pain Visual Analogue Scale (VAS)	<ul style="list-style-type: none"> • Highly recommended for cancer survivors with an EDGE task rating of 4/4 (<i>highly recommended</i>)¹³ • Test-retest reliability of .80, and concurrent validity of .70 in the cancer population.¹⁴ 	<ul style="list-style-type: none"> • The respondents mark where along a 10-cm line they feel their pain intensity is best represented, with the end of the lines representing the extremes (<i>no pain</i> on the left, <i>extreme pain</i> on the right).¹³ • A link to the digital version of the pain VAS can be found in Appendix 1.
Fatigue Numerical Scale (FNS)	<ul style="list-style-type: none"> • 10-point numeric rating scale for fatigue was the best screening assessment for cancer survivors and rated 4/4 by EDGE task force¹⁵ • Sensitivity of 76.3% and a specificity of 87% in 157 advanced lung cancer survivors (median age 63.1 years)¹⁶ 	<ul style="list-style-type: none"> • The respondents use a ten-point scale typically starting with zero (<i>no fatigue</i>) to ten (<i>maximal fatigue</i>) to identify their fatigue level¹⁶ • A link for an example of a 10-point numeric rating scale used for fatigue can be found in Appendix 1.

	<ul style="list-style-type: none"> • Convergent validity of .69 with the Cancer Fatigue Scale (CFS) and a test-retest reliability coefficient of .60 ($p < .001$).¹⁶ 	
Short-Form 36 (SF-36)	<ul style="list-style-type: none"> • Recommended functional assessment tool for assessing health status³ • Researchers reviewed SF-36 data from 10,189 adult survivors of childhood cancer and concluded the SF-36 had good validity and reliability in adult survivors of childhood cancers.¹⁷ 	<ul style="list-style-type: none"> • Each question item is scored on a zero to 100 scale depending on the response, with zero typically meaning no problem or limitations and 100 meaning severe problem or complete limitation in the given domain.¹⁸ • The eight domains are as follows: mental health; social functioning; physical functioning; energy and vitality; role limitation-physical; role limitation-emotional; bodily pain; and general health perception.¹⁷ • A link to the digital version of the SF-36 can be found in Appendix 1.

234 **Table 2.** The left column lists the measures included in the algorithm. The middle column
 235 describes the rationale for inclusion. The right column describes how each measure is scored
 236 and provides a link to the measure in Appendix 1.
 237

238 The purpose of this case report was to create an algorithm that identified the most
 239 common impairments seen in survivors and develop a way to systematically screen for them.

240 The process of the literature review helped identify three screening measures that address
241 many of the common impairments experienced by cancer survivors. The screener can quickly
242 use the pain VAS and FNS to identify pain and fatigue that might be a reason to refer the
243 survivor to rehabilitation services. The SF-36 is a more well-rounded questionnaire that
244 covers major health domains that the pain VAS and FNS would miss. The original plan was
245 to administer the SF-36 upon arrival at the survivorship clinic. Then, the screener could
246 administer the pain VAS and the FNS in the clinic. The idea was the collective information
247 from the three measures together could help guide clinicians on whether the survivor is a
248 good candidate for a referral to rehabilitative services.

249 The initial impression during the onset of this project was that falls were the most
250 common impairment experienced by cancer survivors. The literature review demonstrated
251 pain and cancer-related fatigue are two of the most common impairments experienced by
252 survivors. The ability to screen for those two impairments, as well as providing a screening
253 measure that is broader in its scope, will hopefully be comprehensive enough to become
254 implemented successfully in the survivorship clinic. Contacting individuals at other
255 survivorship clinics to discuss their own experiences, as well as asking them for advice
256 regarding this topic, benefited this project with the final algorithm creation.

257

258 **Application of the Process**

259 As referenced in the Development of the Process section above, a literature review found
260 that pain and fatigue are common impairments seen in survivors. The importance of having
261 screening measures that can identify pain and fatigue was, thus, vital to include in the
262 algorithm. Please refer to Table 2 in the Development of the Process section above for a

263 summary of the interventions used in the algorithm, the rationale for inclusion, and scoring
 264 instructions.

265 Each included measure had its own specific purpose. Please refer to Table 3 for a
 266 summary of the purpose for each measure.

267

268 **Table 3.** Purpose for the Measures Included in the Algorithm

Pain VAS	Purpose: quick and effective way for providers at survivorship clinics to screen for pain that may determine necessity for rehab
Fatigue Numerical Scale	Purpose: quick and effective way for providers at survivorship clinics to screen for cancer-related fatigue that may determine necessity for rehab
Short-Form 36	Purpose: General health and quality of life questionnaire that asks questions across eight domains: mental health; social functioning; physical functioning; energy and vitality; role limitation-physical; role limitation-emotional; bodily pain; and general health perception (See Appendix 1). ¹⁷

269 **Table 3.** The left column lists the screening measure included in the algorithm. The right
 270 column describes the purpose for inclusion into the algorithm.
 271

272 In order to manage the lack of a proper screening protocol, a meeting was coordinated
 273 between the stakeholders, the faculty mentor, and the author in the summer of 2020. The
 274 literature review and formation of the algorithm took place in the summer and early fall of
 275 2020. There was one email communication between the author and the stakeholders in July
 276 2020, where the stakeholders informed the author that no previous management interventions
 277 were attempted to address the screening issue. The author reached out to the stakeholders in

278 September 2020, to discuss their thoughts on the algorithm and its implementation into the
279 survivorship clinic. A meeting between Scott Capozza, MS, PT, the faculty mentor, and the
280 author occurred in October of 2020. Mr. Capozza, a board-certified oncologic specialist in
281 physical therapy at the Yale New Haven Health System's Smilow Cancer Hospital
282 Survivorship Clinic in Connecticut, and recognized as a national expert in oncology
283 rehabilitation, was gracious enough to offer feedback regarding the algorithm.

284 The algorithm has not yet been reviewed by the stakeholders or implemented in the
285 clinic. Mr. Capozza vetted the algorithm and stated that each of the three screening measures
286 in the algorithm would be appropriate for the project. However, Mr. Capozza stated that the
287 algorithm should be as brief as possible. After talking with Mr. Capozza and the faculty
288 mentor, the author decided to discard both the pain VAS and the FNS and only use the SF-
289 36. Since the SF-36 already has sections that ask the survivors about their pain and fatigue,
290 removing the pain VAS and FNS eliminates redundancy and decreases the time to administer
291 and score. The faculty mentor mentioned the Functional Assessment of Cancer Therapy-
292 General (FACT-G). The FACT-G is a quality of life outcome measure that is specifically
293 targeted to those with cancer (see Appendix 2). While the FACT-G could have been chosen
294 for the algorithm, the SF-36 was chosen as it went more in depth into limitation of activities,
295 which may be more beneficial for identifying the need for rehab services. The National
296 Comprehensive Cancer Network (NCCN) distress thermometer as a visual diagram for
297 survivors to rate their distress was recommended for consideration (see Appendix 2). The SF-
298 36 was chosen over the distress thermometer and problem list as it goes more into depth than
299 the NCCN problem list, which only allows yes or no responses. Mr. Capozza also mentioned
300 the algorithm from the American College of Sports Medicine (ACSM) roundtable and
301 Exercise is Medicine (EIM) initiative, which attempts to assist oncology clinicians on what

302 referral pathway is best for cancer survivors with regards to prescribing physical activity.¹⁹
303 Question three of the ACSM algorithm asks whether the oncologic professional believes it is
304 safe for their patient to exercise without medical supervision. If they answer *no*, the
305 algorithm states to refer out to a rehab specialist for follow-up.¹⁹

306 There are many factors that may impact the outcomes of the algorithm implementation.
307 The first factor is whether or not the stakeholders believe this algorithm will be useful in their
308 clinic. Another factor that may impact implementation is whether the providers using the
309 algorithm find it to be both time efficient and effective in identifying survivors for rehab
310 referral. If this goal was found to not be achieved after implementation, that could impact the
311 management interventions and necessitate a change to the algorithm.

312 The theoretical argument this administrative case report attempts to make is that one
313 measure can be sufficient enough to assist oncology professionals determine when to refer to
314 rehabilitation services. The SF-36 addresses pain, fatigue, and mobility limitation all in one
315 measure. The literature review has demonstrated that the SF-36 covers the more common
316 impairments seen in cancer survivors that can be remedied through rehabilitation.

317 Three changes were made to the algorithm. The first was the removal of the pain VAS
318 and the FNS. The SF-36 covers these domains and removing the other measures reduces
319 redundancy and streamlines the referral process. The second is the inclusion of question three
320 of the algorithm proposed by the ACSM.¹⁹ This question allows the oncologic clinician to
321 decide whether they feel comfortable with their patient exercising without medical
322 supervision. The third change was the inclusion of cut-off scores in the SF-36 to determine
323 referral eligibility. Mr. Capozza mentioned that any survivor with moderate or higher scores
324 may be appropriate for rehab services. The reader should note the cut-off scores listed in the

325 Outcomes section are based on the expert opinion of Mr. Capozza, as well as the author's
326 interpretation of what a moderate score would be.

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328 **TIMELINE**

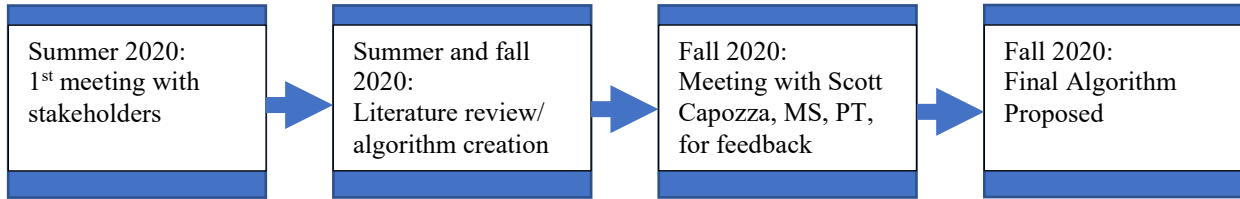
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334 **OUTCOMES**

335 The stakeholders were unavailable to discuss an evaluation of the proposed algorithm or
336 implementation into the survivorship clinic due to the 2020 pandemic. As a result, no
337 outcomes regarding the implementation of the algorithm into the clinic are available.

338 After meeting with Mr. Capozza and the faculty mentor, the final algorithm was
339 established and consisted of two steps. First, question three as proposed by the ACSM would
340 be asked.¹⁹ Subsequently, the SF-36 would be scored to determine referral eligibility. Please
341 refer to Figure 3 for the final proposed algorithm.

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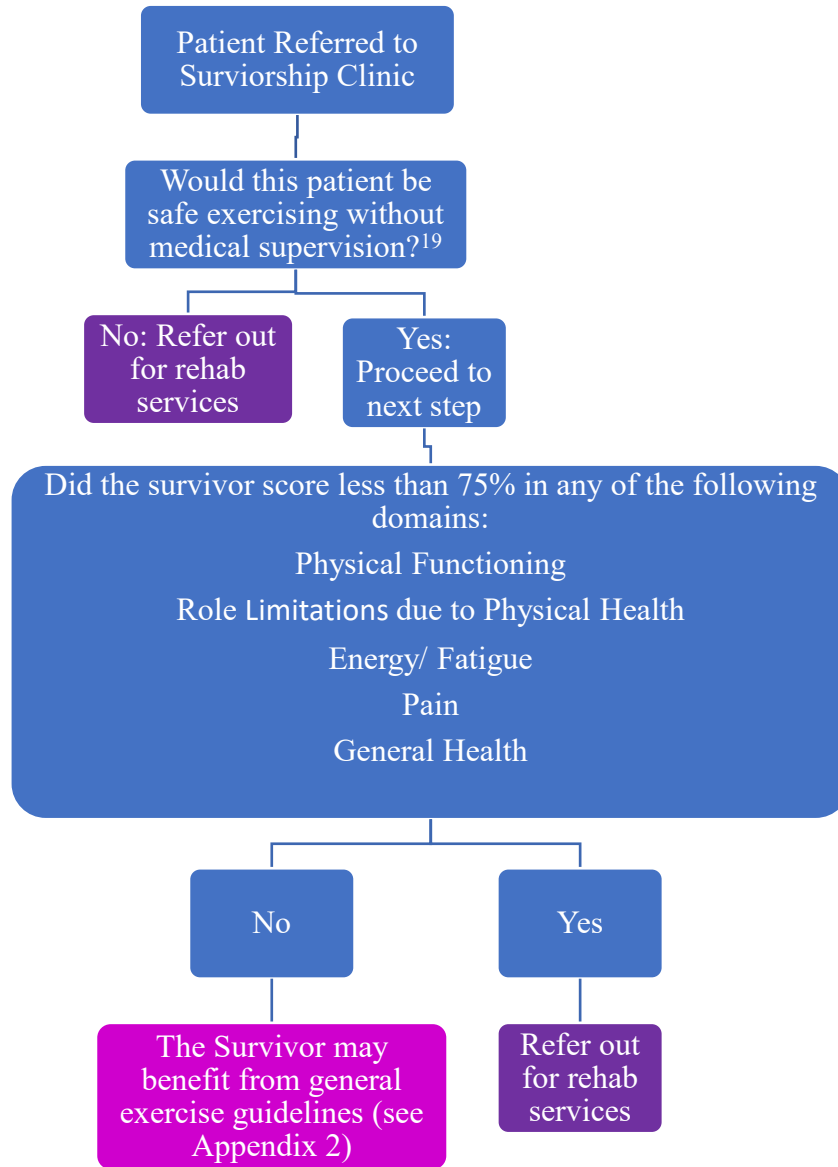
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Figure 3. The Final Proposed Algorithm



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353 **Figure 3.** The algorithm consists of two steps. The first step is for the oncologic clinician to
 354 ask themselves whether they feel this survivor can exercise without medical supervision.¹⁹ If
 355 they answer no, they should refer out for rehab services. If they answer yes, they should then
 356 proceed to score the SF-36. If the survivor scores less than 75% in any of the domains listed
 357 above, the clinician should refer out to rehab services. If the survivor scores 75% or higher in
 358 all the domains listed above, the clinician should refer to Appendix 2 for general exercise
 359 guidelines.
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365 **DISCUSSION**

366 Since the algorithm was not implemented into the survivorship clinic, this project was not
367 able to demonstrate the originally intended purpose. However, a meeting with one of the
368 nation’s experts in oncologic rehab, Mr. Capozza, showed promise that one day it might
369 achieve that purpose. The literature review did, according to Mr. Capozza, provide common
370 impairments seen in cancer survivors and screening measures to identify those impairments.
371 Therefore, the literature review was successful in achieving its intended goal. The final
372 product was a refined algorithm that should be implemented into the clinic successfully if it
373 ever comes to fruition.

374 One of the strengths of this approach was that it was able to provide a succinct and clear
375 algorithm that the oncologic provider can use to determine eligibility for referral to
376 rehabilitation services. With the help of Mr. Capozza and the faculty mentor, the final end
377 product is efficient and practical. The main limitation of this approach was that it required
378 implementation in the clinic to determine success. Since it was not implemented into the
379 clinic, it is tough to discern the clinical utility of the algorithm at this time.

380 The goal of this project was to create an algorithm that was evidence-based, efficient and
381 comprehensive. The conclusion and main take-away for this project is that an algorithm used
382 to refer survivors to rehab services needs to be comprehensive, yet brief. Fulfilling these two
383 diametrically opposed requirements was one of the most challenging aspects of the algorithm
384 creation process.

385 If this algorithm is implemented within a survivorship clinic, the potential implications
386 could be profound. If the algorithm is found to be effective at screening survivors, it may
387 result in more survivors getting their rehabilitation needs addressed and potentially
388 improving their quality of life.

389 More research should be done to determine how to optimize the referral process. There
390 needs to be greater implementation of the already proposed algorithms, including the one
391 proposed here, and that proposed by Stout et al⁶, into survivorship clinics. From there it can
392 be determined whether the measures are specific enough, or the cut off scores are accurate.
393 For example, if a rehab clinic gets overwhelmed with survivors, they might need to increase
394 the cut-off scores of the measures. Only through this trial and error can the algorithms be
395 developed, refined, and improved. If future research focuses on these aspects of screening,
396 cancer survivors will be well on their way to getting the rehabilitation care they need and
397 deserve.

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491 **TABLES and FIGURES**

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Table 1. Common Impairments and Reasons to Refer to Rehabilitation³

Impairment Category Domain	Reasons for Referral to Rehabilitation
General Physical	Difficulty returning to premorbid activities Fatigue Joint pain Musculoskeletal pain Neuropathic pain Referred Pain Weakness Deconditioning
Specific Physical	Autonomic dysfunction Back pain Balance dysfunction Bowel dysfunction Cervical range-of-motion limitations Chemotherapy-induced peripheral neuropathy Chest/thoracic pain Cognitive impairment Compression neuropathy
Functional	Difficulty with ADLs (dressing/bathing, etc) ▪ Difficulty with IADLs (chores/shopping, etc) ▪ ▪ Prosthetics Assistive devices (cane, reacher, etc) Adaptive equipment needs Durable medical equipment needs Home safety evaluation Workplace evaluation Driving evaluation

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495 **Table 1.** The left column describes the common impairment domains seen in survivors. The right
 496 column lists various reasons in each domain a survivor may be referred to rehabilitation. ▪ ADLs:
 497 Activities of Daily Living, ▪ ▪ IADLs: Instrumental Activities of Daily Living.³

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Table 2. Screening Measures Selected with Rationale for Inclusion and Scoring Instructions

Screening Measures	Rationale for Inclusion	Scoring Instructions
Pain Visual Analogue Scale (VAS)	<ul style="list-style-type: none"> • Highly recommended for cancer survivors with an EDGE task rating of 4/4 (<i>highly recommended</i>)¹³ • Test-retest reliability of .80, and concurrent validity of .70 in the cancer population.¹⁴ 	<ul style="list-style-type: none"> • The respondents mark where along a 10-cm line they feel their pain intensity is best represented, with the end of the lines representing the extremes (<i>no pain</i> on the left, <i>extreme pain</i> on the right).¹³ • A link to the digital version of the pain VAS can be found in Appendix 1.
Fatigue Numerical Scale (FNS)	<ul style="list-style-type: none"> • 10-point numeric rating scale for fatigue was the best screening assessment for cancer survivors and rated 4/4 by EDGE task force¹⁵ • Sensitivity of 76.3% and a specificity of 87% in 157 advanced lung cancer survivors (median age 63.1 years)¹⁶ • Convergent validity of .69 with the Cancer Fatigue 	<ul style="list-style-type: none"> • The respondents use a ten-point scale typically starting with zero (<i>no fatigue</i>) to ten (<i>maximal fatigue</i>) to identify their fatigue level¹⁶ • A link for an example of a 10-point numeric rating scale used for fatigue can be found in Appendix 1.

	Scale (CFS) and a test-retest reliability coefficient of .60 ($p < .001$). ¹⁶	
Short-Form 36 (SF-36)	<ul style="list-style-type: none"> Recommended functional assessment tool for assessing health status³ Researchers reviewed SF-36 data from 10,189 adult survivors of childhood cancer and concluded the SF-36 had good validity and reliability in adult survivors of childhood cancers.¹⁷ 	<ul style="list-style-type: none"> Each question item is scored on a zero to 100 scale depending on the response, with zero typically meaning no problem or limitations and 100 meaning severe problem or complete limitation in the given domain.¹⁸ The eight domains are as follows: mental health; social functioning; physical functioning; energy and vitality; role limitation-physical; role limitation-emotional; bodily pain; and general health perception.¹⁷ A link to the digital version of the SF-36 can be found in Appendix 1.

501 **Table 2.** The left column lists the measures included in the algorithm. The middle column
 502 describes the rationale for inclusion. The right column describes how each measure is scored
 503 and provides a link to the measure in Appendix 1.

504 **Table 3.** Purpose for the Measure Included in the Algorithm

Pain VAS	Purpose: quick and effective way for providers at survivorship clinics to screen for pain that may determine necessity for rehab
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<p>Fatigue Numerical Scale</p>	<p>Purpose: quick and effective way for providers at survivorship clinics to screen for cancer-related fatigue that may determine necessity for rehab</p>
<p>Short-Form 36</p>	<p>Purpose: General health and quality of life questionnaire that asks questions across eight domains: mental health; social functioning; physical functioning; energy and vitality; role limitation-physical; role limitation-emotional; bodily pain; and general health perception (See Appendix 1).¹⁷</p>

506 **Table 3.** The left column lists the screening measure included in the algorithm. The right
 507 column describes the purpose for inclusion into the algorithm.
 508

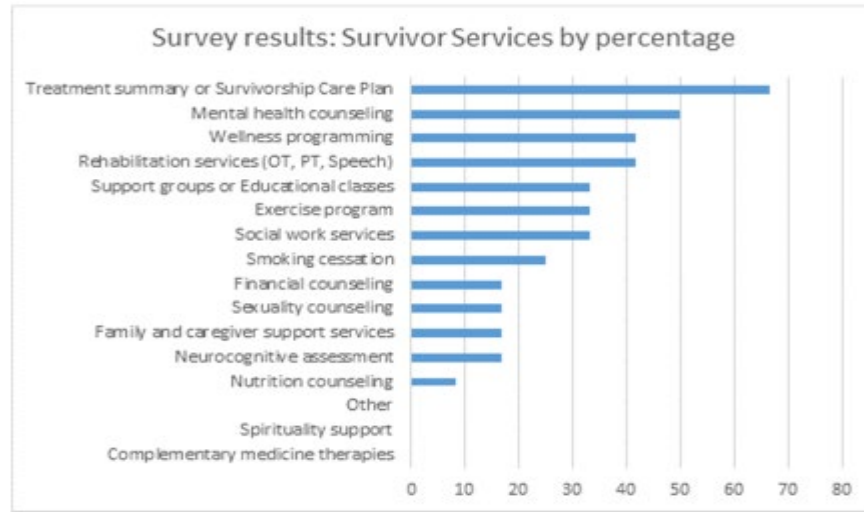
509 **Figure 1.** A List of Services Offered by the Survivorship Clinic

Service	We Offer	Referral
Survivorship Care Plans	✓	
Survivorship Clinic	✓	
Mental Health Counseling (LCSW)	✓	
Psychiatric services	✓	
Social Work	✓	
Wellness programming		✓
Rehabilitation – PT, OT		✓
Speech-language therapy	✓	
Support Groups, Education		✓
Exercise		✓
Social work	✓	
Smoking cessation	✓	✓
Financial counseling	✓	✓
Sexuality counseling		
Family & Caregiver support		✓
Neurocognitive assessment	✓	
Nutrition	✓ *	
Spirituality		
Complementary Medicine	✓	✓
Specialty services – pulmonary, fertility	✓	✓
Cardio-oncology	✓	
Screening for recurrence	✓	✓
Screening for new cancers	✓	✓
Other		

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 511 **Figure 1.** The left column lists the services offered by the survivorship clinic. The right
 512 column lists the services that the survivorship clinic has to make an outside referral for
 513 (Barbra Perry, Survivorship Clinic Manager, Email Communication, July 21st, 2020).

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Figure 2. Percentage of Services Used by Survivors



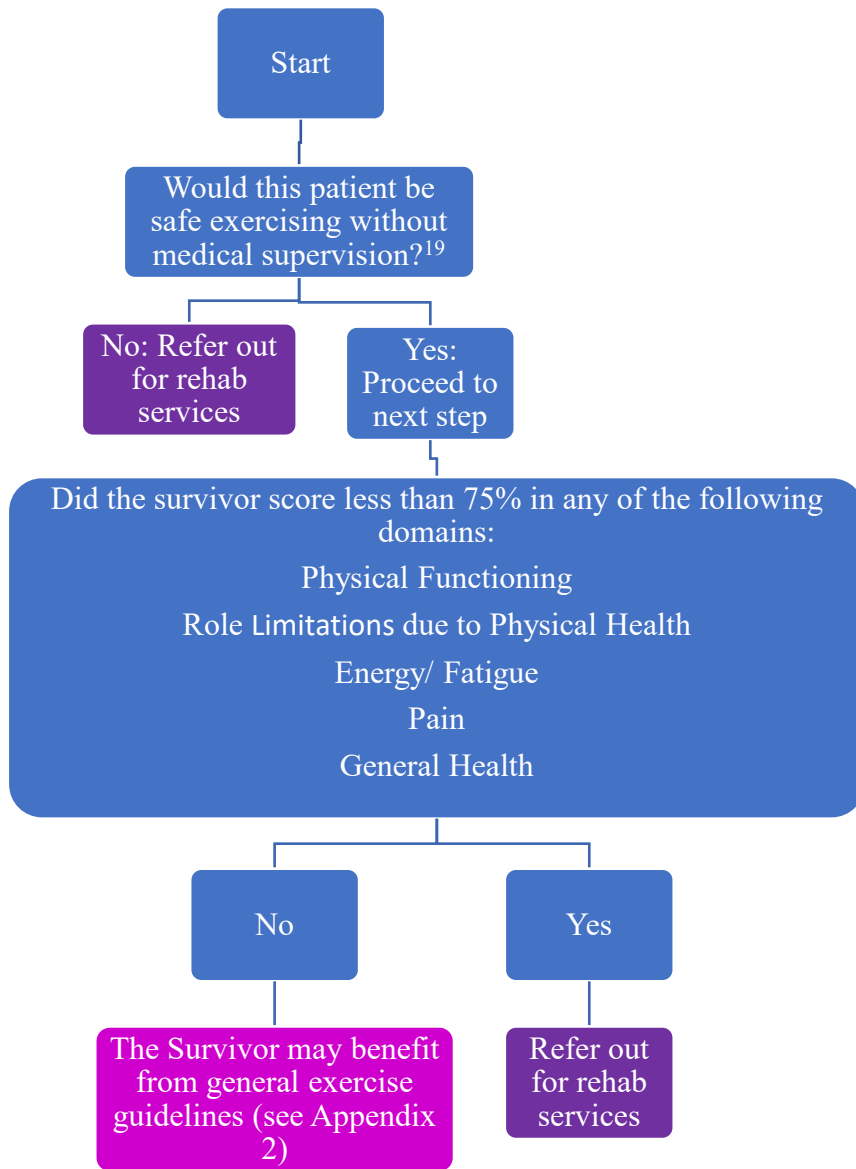
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517 **Figure 2.** On the left are the potential services available for a survivor at this survivorship
518 clinic. On the right is the percentage of survivors (sample size unavailable) who used the
519 service (Barbra Perry, Survivorship Clinic Manager, Email Communication, July 21st, 2020).

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Figure 3. The Final Proposed Algorithm



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523 **Figure 3.** The algorithm consists of two steps. The first step is for the oncologic clinician to
 524 ask themselves whether they feel this survivor can exercise without medical supervision.¹⁹ If
 525 they answer no, they should refer out for rehab services. If they answer yes, they should then
 526 proceed to score the SF-36. If the survivor scores less than 75% in any of the domains listed
 527 above, the clinician should refer out to rehab services. If the survivor scores 75% or higher in
 528 all the domains listed above, the clinician should refer to Appendix 2 for general exercise
 529 guidelines.

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536 **APPENDICES**

537 Appendix 1:

538 Visual Analogue Scale for pain:

539 https://www.physiotherapyalberta.ca/files/pain_scale_visual_and_numerical.pdf

540 Visual Analogue Fatigue Scale (below Fatigue Severity Scale):

541 <https://www.sralab.org/sites/default/files/2017-06/sleep-Fatigue-Severity-Scale.pdf>

542 SF-36 questionnaire:

543 <https://www.orthotoolkit.com/sf-36/>

544 Appendix 2:

545 FACT-G:

546 <https://8beeac51-650b-405c-97a4>

547 0987e05a41f1.filesusr.com/ugd/626819_acb819ba51fd4552807feef38250db3f.pdf

548 National Comprehensive Cancer Network (NCCN) Distress thermometer

549 https://www.nccn.org/patients/resources/life_with_cancer/pdf/nccn_distress_thermometer.pdf

550 [f](#)

551 General Exercise Guidelines for Cancer Survivors:

552 <https://journals.lww.com/acsm->

553 [msse/FullText/2019/11000/Exercise_Guidelines_for_Cancer_Survivors_.23.aspx](https://msse.FullText/2019/11000/Exercise_Guidelines_for_Cancer_Survivors_.23.aspx)

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560 **Modified Administrative CARE Checklist**

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CARE Content Area	Page
1. Title – The area of focus and “case report” should appear in the title	Pg. 1562
2. Key Words – Two to five key words that identify topics in this case report	Pg. 1563
3. Abstract – (structure or unstructured) a. Introduction – What is unique and why is it important? b. The main concerns and important findings. c. The main management problem, interventions, and outcomes. d. Conclusion—What are one or more “take-away” lessons?	Pg. 2564 565
4. Introduction – Briefly summarize why this case is unique with literature references.	Pg. 3-6
5. Setting Information a. De-identified people and institution. b. Main concerns and management problem. c. History of the situation. d. Relevant past management interventions and their outcomes.	Pg. 6-10
6. Findings – Relevant examination and description of the management problem	Pg. 6-10
7. Timeline – Relevant data about assessment and management intervention organized as a timeline (figure or table).	Pg. 18
8. Assessment a. Outcome measurement tools utilized to assess the problem and outcomes b. Challenges related to assessing the problem. c. Prognostic indicators of the success of the management intervention.	Pg. 10-14
9. Management Intervention a. Types of intervention provided / implemented (pharmacologic, surgical, preventive). b. How management interventions were provided. c. Changes in the interventions with explanations.	Pg. 14-18
10. Follow-up and Outcomes a. Management assessment of outcomes when appropriate. b. Important follow-up actions / plans. c. Intervention adherence and tolerability in the future. d. Adverse and unanticipated events.	Pg. 18-19
11. Discussion a. Strengths and limitations in your approach to this case. b. Discussion of the relevant literature. c. The rationale for your conclusions. d. The primary “take-away” lessons from this case report.	Pg. 20-21
12. Stakeholder Perspective – The manager can share their perspective on their case.	Pg. 9-10
13. Consent – The manager should give informed consent.	Pg. 6