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How do iLead? Validation of a Scale Measuring Active and Passive Implementation Leadership

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How do iLead?

Validation of a Scale Measuring Active and Passive Implementation Leadership

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67 **Keywords:** implementation leadership, validation, scale, CFA, Full-Range Leadership Model

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68 **Word count:** 5361

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71 **Abstract**

72 **Objectives:** This validation study aims to describe the creation of a scale – the iLead scale – through
73 adaptations of existing domain-specific scales that measure active and passive implementation
74 leadership, and to describe the psychometric properties of this scale.

75 **Methods:** Respondents were 336 healthcare professionals (90% female and 10% male; mean age 47
76 years) whose first- and second-line managers participated in a transformational leadership intervention
77 to train healthcare managers in implementation leadership. This was performed in the Stockholm
78 regional healthcare organization that offer primary, psychiatric, rehabilitation, and acute hospital care,
79 among other areas. The items for measuring implementation leadership were based on extant research
80 and the Full-Range Leadership Model. Confirmatory factor analysis was performed to evaluate the
81 dimensionality of the scale, followed by tests for reliability and convergent, discriminant and criterion-
82 related validity using correlations and multilevel regression analyses.

83 **Results:** The final scale consists of 16 items clustered into four subscales representing active
84 implementation leadership, and one scale signifying passive implementation leadership. Findings
85 showed that the hypothesized model had an acceptable model fit ($\chi^2_{(99)}=382.864^{**}$, CFI=.935,
86 TLI=.911, RMSEA=.059). The internal consistency and convergent, discriminant and criterion-related
87 validity were all satisfactory.

88 **Conclusions:** The iLead scale is a valid measure of implementation leadership and is a tool for
89 understanding how active and passive leader behaviours influence an implementation process. This
90 brief scale may be particularly valuable to apply in training focusing on facilitating implementation,
91 and in evaluating leader training. Moreover, the scale can be useful in evaluating various leader
92 behaviours associated with implementation success or failure.

94 **Strengths and limitations of this study**

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3 95 • This study explored the factor structure, reliability and validity of the iLead scale – the first
4 96 scale that assesses both active and passive implementation-specific leadership based on the
5 97 Full Range Leadership Model.
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7
8 98 • The iLead scale is a brief and pragmatic scale that can be used in trainings focusing on
9 99 facilitating implementation, in clinical practice to assess implementation leadership in order to
10 100 improve implementation processes in the daily practice as well as in healthcare research.
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14 101 • A confirmatory factor analysis (CFA) was performed to confirm the factor structure since the
15 102 iLead scale was based on theory and established scales, in addition to tests concerning
16 103 reliability and validity.
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20 104 • The *active management-by-exception* factor of the Full Range Leadership Model was
21 105 excluded from the iLead scale since the objective was to only incorporate leader behaviours
22 106 that can be clearly distinguished into an overall active or passive implementation leadership
23 107 category.
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28 108 • The number of items in each sub-scale differed based on results from the validation process,
29 109 where items that did not capture the intended construct or had low correlations were excluded.
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112 **Introduction**

113 Implementing change in healthcare is a complex and challenging task.^{1,2} Nonetheless, this effort is
114 essential for keeping healthcare professionals up to date on, and ensuring their use of new research
115 evidence so patients can receive the best possible care. Researchers have identified a wide range of
116 contextual factors that influence effective implementation,³⁻⁵ one of which is leadership.⁶⁻⁸
117 Managers' attitudes regarding, and behaviours during, an implementation are crucial for effectively
118 achieving change in practice. This is particularly true for line managers (i.e. those with a managerial
119 position closest to employees) who have a direct influence on employees' implementation

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3 120 behaviours.^{9,10} Research has recognized managerial and leader behaviours that influence an
4
5 121 implementation process as being supportive, providing feedback, communicating clearly, being a role
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7 122 model, encouraging employee development, and creating a context conforming to the implementation,
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9 123 for instance by providing resources.^{7,11-13} However, this research has seldom relied on leadership
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11 124 theory to study the quality of the actions leaders take; this despite a long history of theoretical
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13 125 leadership research in multiple disciplines.¹⁴ Leadership theory can facilitate the understanding of both
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15 126 what managers do (e.g. provide information about the implementation) and how these actions are
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17 127 performed (e.g. if the information is provided in a way that inspires employees), thereby explaining
18
19 128 the relationship between leadership and implementation outcomes. The scale validated in this study
20
21 129 focuses on capturing line managers' implementation-specific leader behaviours – both what they do
22
23 130 and how these actions are performed – based on the active and passive dimensions of the Full-Range
24
25 131 Leadership Model.

132

133 **The Full-Range Leadership Model**

134 The Full-Range Leadership Model (FRLM) is the most comprehensively researched approach to
135 leadership.¹⁵⁻¹⁸ The model clusters leader behaviours into two broad dimensions signifying active and
136 passive leadership.¹⁸⁻²¹ Transformational leadership is one factor of active leadership^{18,21} and is
137 associated with beneficial individual and organizational outcomes,²² employee performance,²³ the
138 change process^{24,25} and organizational innovation²⁶ in various contexts and cultures.²⁷ There is also
139 emerging evidence on the positive relationship between transformational leadership and effective
140 implementation.¹⁰ For instance, transformational leader behaviours have been strongly related to
141 employees' innovation implementation behaviour²⁸ and their commitment to change.²⁹
142 Transformational leaders inspire employees to achieve higher goals and to perform at a higher level
143 than expected. These leader behaviours were originally divided into three sub-factors: *idealized*
144 *influence*, acting as a role model and building relationships with employees based on trust and respect;
145 *individualized consideration*, coaching of staff and helping them develop, while conveying empathy
146 for their needs and desires; and *intellectual stimulation*, encouraging employees to be creative and to

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3 147 challenge assumptions.²¹ *Inspirational motivation* was later added as another sub-factor to
4
5 148 transformational leadership.^{30,31} This sub-factor concerns articulating a clear and compelling vision to
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7 149 employees and motivating them to achieve set goals.³¹ It has been argued that these four
8
9 150 transformational leadership sub-factors are related, however it has proved problematic to distinguish
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11 151 between them,^{18,31} mainly through difficulties in empirically supporting discriminant validity (i.e. high
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13 152 intercorrelations between the sub-factors).^{19,30,32,33} Consequently, different approaches to conceptualize
14
15 153 and measure transformational leadership has been adopted. Some have measured it as a global
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17 154 construct,^{26,33} whereas others have examined all individual sub-factors of transformational
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19 155 leadership.^{34,35} Yet others have used a reduced set of factors.³⁶ It has been especially difficult to
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21 156 distinguish between *idealized influence* and *inspirational motivation*, both conceptually^{18,37} and
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23 157 empirically.^{19,31,38} Thus, some have combined *idealized influence* and *inspirational motivation* into one
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25 158 sub-factor.^{22,30,38-40}

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29 160 Another dimension of active leadership is *contingent reward*.^{19,21} This sub-factor is the most active
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31 161 form of transactional leadership and involves an exchange relationship between manager and
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33 162 employees, for instance setting mutually agreed-upon goals and linking them to rewards. Contingent
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35 163 reward behaviours have been linked to employees' performance outcomes²³ and satisfaction.¹⁹ Current
36
37 164 suggestions are that a combination of transformational leadership and contingent reward is most
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39 165 effective in producing positive organizational outcomes.^{16,23,37,41} Based on this, contingent reward is
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41 166 likely to be an important component of active implementation leadership.

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43 167
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45 168 Passive leadership includes two dimensions.^{18,20,21} One of these is *passive management-by-exception*, a
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47 169 sub-factor of transactional leadership.^{20,42} This refers to manager behaviours related to acting first
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49 170 when something has gone wrong, or correcting employee actions when these have been brought to
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51 171 their attention. This sub-factor has been shown to be ineffective in achieving organizational outcomes,
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53 172 such as safety at work,²⁰ and to negatively impact performance.²³ The other passive leadership
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55 173 dimension is *laissez-faire leadership*, leaders abdicate responsibility and avoid taking initiative.¹⁸ This

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3 174 type of non-leadership is also ineffective for achieving positive outcomes,^{16,20} and is an overall
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5 175 destructive leader behaviour.⁴³ *Passive management-by-exception* and *laissez-faire leadership* have
6
7 176 been combined in previous studies to represent a generalized passive leadership construct.^{18,20,27,42}
8
9 177 These behaviours are typically highly correlated with each other and related to negative employee and
10
11 178 organizational outcomes, and negatively associated with active leadership.

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13 179 An additional sub-factor of the transactional leadership construct is *active management-by-exception*.⁴²
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15 180 This type of leader behaviour, added to later versions of the FRLM, is characterized in terms of
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17 181 monitoring for and detecting mistakes that deviate from the norm, and taking corrective action when
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19 182 errors occur.^{18,30} There is an ongoing discussion as to whether *active management-by-exception* fits
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21 183 into the passive or the active categories of leadership⁴² or should be represented separately.⁴¹ Some
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23 184 have shown that *active* and *passive management-by-exception* are separate constructs that are either
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25 185 uncorrelated, or somewhat negatively correlated.^{18,42} Thus, *active management-by-exception* can be
26
27 186 argued to be an active way of managing in comparison to the passive leader dimensions. However, in
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29 187 comparison to the active leadership dimensions, *active management-by-exception* is more reactive
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31 188 than proactive and cannot be considered an effective leadership style. Consequently, due to this
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33 189 unclear positioning to either the active or the passive leadership dimensions on the FRLM continuum,
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35 190 *active management-by-exception* was not included in this study.

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40 192 To date, leadership research has mostly focused on measuring active leader behaviours to identify
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42 193 which ones are effective and positively influence organizational outcomes. However, capturing
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44 194 passive leader behaviours that negatively influence employees is also of great importance, as these can
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46 195 have disastrous consequences^{20,43,44} and will most likely influence the implementation process. The
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48 196 research on implementation leadership has hitherto emphasized behaviours that are effective for
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50 197 implementing change, naturally, since these are needed to achieve implementation success. However,
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52 198 it is also important to consider and measure leader behaviours that may be disruptive to, and hinder, an
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54 199 implementation process. This is important, since the way managers lead an implementation can
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56 200 influence the implementation climate both positively and negatively^{20,45}. Implementation climate

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3 201 involves employees' shared perceptions of an implementation initiative's practical value.⁴⁶ Research
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5 202 has demonstrated the relevance of implementation climate for the association between
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7 203 transformational leadership and employees' commitment to change.²⁸ Moreover, active leadership may
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9 204 also promote a positive implementation climate,^{47,48} and thus influence implementation success. This
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11 205 highlights the importance of capturing both the active and passive aspects of leadership.^{18,20}
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16 207 **Implementation-Specific Leadership**

18 208 Recent research on leadership has indicated that leader behaviours directed at a particular initiative or
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20 209 objective, often referred to as domain-specific leadership,^{20,49,50} appear to be more effective than
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22 210 general leader behaviours for reaching the goals of this initiative. Consequently, general active leader
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24 211 behaviours do not seem to be sufficient for affecting a specific domain. In the areas of occupational
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26 212 safety⁵¹, employee health and well-being⁵² and service climate,⁵⁰ this has led to the development of
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28 213 domain-specific FRLM-scales. Several of these scales build on the theory of the FRLM, however
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30 214 specifically ask the rater to consider leader behaviours in relation to a specific domain. When
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32 215 implementing changes in the healthcare context, this might mean that leader behaviours directed at a
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34 216 specific implementation initiative might be necessary for the success of the implementation process,
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36 217 rather than expecting general active leadership to have an impact. Hence, general leadership may
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38 218 foster a good work environment and performance overall, but may be insufficient for fostering
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40 219 implementation success for a specific evidence-based method to improve the delivery of healthcare. It
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42 220 is therefore necessary to measure leader behaviours specific to an implementation process. This also
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44 221 means that although there is a variety of theory-based scales that measure general leadership,⁵³ these
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46 222 may not effectively predict the outcomes of an implementation process.^{54,55}
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51 224 To date, there is one implementation-specific leadership scale:⁵⁶ the Implementation Leadership Scale
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53 225 (ILS) measures strategic leadership in the implementation of evidence-based practices (EBPs), and
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55 226 assesses active leader behaviours that promote implementation of EBPs.⁵⁶ We argue for three main
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3 227 reasons to construct a new scale to measure implementation leadership. First, no scale currently exists
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5 228 that measures active and passive leader behaviours in relation to implementation. This is an important
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7 229 aspect to be included in an implementation leadership scale since passive leader behaviours can have
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9 230 detrimental effects on employees,^{20,23} and consequently also for an implementation process. Second,
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11 231 although Aarons et al. (2014) considered the active leader behaviours of the FRLM when developing
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13 232 the ILS,⁵⁶ the aim was to assess independent and different aspects of implementation leadership. Thus,
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15 233 at present, no implementation leadership scale exists that operationalize the FRLM theory. We suggest
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17 234 that a scale measuring implementation leadership and maintains the FRLM structure is important for
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19 235 obtaining more detailed information about leader behaviours.³⁵ Third, the ILS focuses on what
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21 236 managers do when leading implementation (e.g. developing a plan to facilitate the process) than how it
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23 237 is done (e.g. whether these tasks have been performed in a way that inspires employees). We suggest
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25 238 that an implementation leadership scale that, in addition to measuring what, measures how managers
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27 239 lead implementation is valuable for managers in their development as an implementation leader.

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31 241 In conclusion, the aim of this study is to adapt previous domain-specific scales^{20,57} to create an active
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33 242 and passive implementation-specific leadership scale that follows the factor structure of the FRLM,
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35 243 and to validate this scale. The objective of the iLead scale is to complement a previous implementation
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37 244 leadership scale (ILS) by capturing both effective and disruptive implementation leader behaviours by
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39 245 basing the scale on the active and passive dimensions of the FRLM, and to capture what leaders do in
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41 246 addition to how they perform these behaviours. Four subscales are predicted for active implementation
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43 247 leadership and one subscale for passive implementation leadership.

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47 48 49 249 **Methods**

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53 54 55 251 **Adapting previous domain-specific scales to construct the iLead scale**

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3 252 As a first step, a literature search was performed to identify key research relating to implementation
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5 253 leadership, including previously validated scales. This informed the decision that the scale should
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7 254 follow the factor structure of the FRLM, thus including both active and passive leader behaviours, and
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9 255 be adapted from existing scales. The basis for the construction of the iLead scale was two validated
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11 256 domain-specific leadership scales.^{20,49} We adapted the items from the scale developed by Kelloway et
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13 257 al. (2006),²⁰ which measures transformational and passive safety leadership and follows the factor
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15 258 structure of the FRLM, to be implementation specific. For instance, the original item ‘My manager
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17 259 shows determination to maintain a safe work environment’ was adapted to ‘My manager has shown
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19 260 determination to maintain the implementation of *the new working method*’. We complemented this
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21 261 with the subscale ‘line managers’ attitudes and actions’ from the Intervention Process Measure (IPM)
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23 262 by Randall et al. (2009).⁵⁷ This scale specifically focuses on managerial behaviours in relation to
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25 263 occupational health interventions and is one of the few widely used scales attempting to tap into
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27 264 change leadership. The items were adapted slightly to be applicable for the implementation area (see
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29 265 Supplementary appendix 1 for the original and adapted items). This process resulted in a 20-item scale
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31 266 assessing implementation-specific leadership.

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35 268 The iLead scale was developed as a part of an implementation leadership training intervention (the
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37 269 iLead intervention⁵⁸). It was used as a tool to provide feedback for managers on their leader
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39 270 behaviours. It was therefore important that the scale could distinguish between different types of active
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41 271 and passive leader behaviours, as previously suggested.^{32,35} Hence, a differentiation between the
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43 272 factors was sought. Although idealized influence and inspirational motivation may be argued to be
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45 273 conceptually different,^{37,40} studies have not been able to consistently empirically separate these sub-
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47 274 factors.^{39,40} Therefore, idealized influence and inspirational motivation were combined and named
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49 275 ‘*exemplary behaviours*’, which is in line with previous studies using the FRLM.^{30,36,38} Consequently,
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51 276 the iLead scale measures active implementation leadership, from here on referred to as active
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53 277 leadership, through four subscales – the *exemplary behaviours* (7 items), *individualized consideration*
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55 278 (3 items), *intellectual stimulation* (5 items) and *contingent reward* (2 items). Passive implementation

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3 279 leadership, from here on referred to as passive leadership, comprises elements from both *passive*
4 280 *management-by-exception* and *laissez-faire* leader behaviours (3 items), in line with a previous scale
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6 281 measuring domain-specific leadership.²⁰
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11 283 **Assurance of content validity**

14 284 In addition to basing the iLead items on existing scales, two additional approaches were used to assure
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16 285 content validity.⁵⁹ National experts in the field of leadership and implementation (n=5) and managers
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18 286 in a healthcare organization (n=40) were invited to a workshop to identify crucial implementation
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20 287 leader behaviours. A structured process – Co-created program theory (COP) – was used.⁶⁰ The first
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22 288 step was to individually brainstorm leader behaviours perceived as important in implementation.
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24 289 Thereafter the participants categorized these behaviours into overall themes. Examples of themes
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26 290 were: ‘inspire and motivate employees’ and ‘be responsive to employees’ needs’. Third, to test the
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28 291 face validity of the scale,⁵⁹ employees and senior managers (n=11) representing the healthcare
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30 292 organizations completed a draft of the questionnaire and were asked for oral feedback on whether the
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32 293 items were clearly formulated, relevant and understandable, and if they perceived that the scale
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34 294 measured the construct it aimed to measure. This did not lead to any major changes to the items.
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39 296 **Participants**

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42 297 The data for the present study was collected as part of a larger trial in which an implementation
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44 298 leadership training intervention was developed and evaluated in the Stockholm regional healthcare
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46 299 organization.⁵⁸ This organization offers primary, psychiatric, rehabilitation, and acute hospital care,
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48 300 among other areas. The data used in the present study originates from the baseline measurement (Time
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50 301 1), conducted in November/December 2015, with the exception of one scale collected from the first
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52 302 follow-up (Time 2) in May/June 2016 to assess predictive criterion validity. All employees whose
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54 303 managers were taking part in the intervention and who were not on leave of absence, parental leave,
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56 304 had quit their job, etc. were invited to participate in the study. Employee data was used since

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3 305 managers' self-ratings are often inflated due to leniency bias,^{61,62} and previous studies have
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5 306 demonstrated the validity of using employees' assessments of leader behaviours.^{63,64} Out of 1,084
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7 307 eligible healthcare professionals, 815 responded (75% response rate) to the baseline measurement
8
9 308 (Time 1). Of these, 336 respondents (41%) answered the iLead scale. The reason why there were
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11 309 fewer employees eligible to answer the questionnaire was that a filter was included at the beginning of
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13 310 the questionnaire to ensure that only respondents who could remember a specific implementation, and
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15 311 thus respond to questions about their manager's implementation leadership, answered the iLead scale
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17 312 questions. Through the filter, respondents received instructions to reflect on an implementation their
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19 313 manager had led during the past six months, which they also had to identify in the questionnaire.
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21 314 Subsequently, only those respondents who could identify an implementation answered the iLead
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23 315 questionnaire, and were instructed to replace the phrase '*the new working method*' in each question of
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25 316 the iLead scale with the implementation they had identified in the filter question.

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30 318 The follow-up measurement was performed immediately after the implementation leadership training
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32 319 intervention (Time 2),⁵⁸ six months after the baseline measurement. The purpose of using data at Time
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34 320 2 was to assess the predictive type of criterion validity (i.e. using a criterion that occurs in the
35
36 321 future).⁵⁹ Thus, data on implementation climate was used since active leadership is an important
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38 322 predictor of a positive implementation climate.^{46,48} A total of 490 respondents answered the
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40 323 questionnaire at Time 2, and 443 (90%) of these answered all the implementation climate items.

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45 325 The majority of respondents were female (90%) and had worked at their current job for two to five
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47 326 years (26.8 %). This is representative of the healthcare context in Sweden.⁶⁵ The participants' mean
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49 327 age was 47 years (SD=11.8; Range: 22 – 65). Most participants, 79.6%, had obtained a university
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51 328 degree; 18.7% had a college degree; and 1.7% had no further education, i.e. lower than a college
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53 329 degree.

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3 331 **Procedure**
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5 332 The respondents received a secured link to an electronic questionnaire through their work e-mail,
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7 333 including information about the study and the purpose of the questionnaire. Two reminders were sent,
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9 334 with a two-week time interval. All participants provided informed consent that their data could be used
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11 335 in research, and confirmed that they understood that participation was voluntary and that they could
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13 336 withdraw their participation at any time. The local ethics committee in Stockholm (ref no. 2015/857-
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15 337 31/5) approved the data collection for the project.
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20 339 **Measures**

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22 340 *Implementation-specific active and passive leadership* was measured through the iLead scale
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24 341 (described above). All 20 items were scored on a 1 (strongly disagree) to 5 (strongly agree) Likert
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26 342 scale.
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30 344 *Convergent and discriminant validity measures*

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33 345 *General transformational leadership* was measured through the Global Transformational Leadership
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35 346 (GTL) scale³³ using seven items. An example item is: ‘My closest manager communicates a clear and
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37 347 positive vision of the future’. Items were scored on a 1 (strongly disagree) to 5 (strongly agree) Likert
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39 348 scale. Cronbach’s alpha was .95.
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44 350 *General transactional leadership* was measured through two items used in previous research that are
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46 351 based on the Multifactor Leadership Questionnaire (MLQ), modified to be implementation-
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48 352 specific.^{18,20} The items focus on contingent reward behaviours, for example: “My manager shows
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50 353 satisfaction when employees meet expectations”. Items were scored on a 1 (strongly disagree) to 5
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52 354 (strongly agree) Likert scale. Cronbach’s alpha was .81.
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3 356 *Criterion-related validity measure*
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5 357 *Implementation climate* was measured with three items derived from the subscale ‘Focus on EBP’ of
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7 358 the Implementation Climate Scale (ICS)⁴⁶ (collected at Time 2). These items were deemed relevant for
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9 359 assessing implementation climate due to their specific nature, and were therefore adapted to the
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11 360 present study. For example, “Using evidence-based practices is a top priority in this team/agency” was
12
13 361 changed to “At my workplace it is a top priority to change our working methods in order to achieve
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15 362 the best possible quality”. Items were scored on a 1 (strongly disagree) to 5 (strongly agree) Likert
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17 363 scale. Cronbach’s alpha was .86.
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21 365 **Statistical analyses**

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24 366 Two major approaches were used to validate the scale.⁵⁹ Its dimensionality was evaluated through
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26 367 confirmatory factor analysis (CFA) using AMOS 23. CFA was chosen over an exploratory factor
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28 368 analysis (EFA) since the factor structure of the implementation-specific scale (i.e. FRLM) is well
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30 369 established in the literature and has prior validity evidence.^{19,30,66,67} This is also in line with previous
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32 370 studies of domain-specific scales based on the FRLM.²⁰ Thus, CFA is used to deductively confirm that
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34 371 the data in the present study fits into the already proposed factor structure, whereas an EFA is more
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36 372 inductive in its approach and should be used when developing new scales with items that have not
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38 373 been tested in terms of reliability and validity.⁶⁸ The maximum likelihood estimation (ML) approach
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40 374 was used to address missing data values.⁶⁹ One path indicator for each latent variable was fixed to set
41
42 375 the scale of the latent variable. Model fit was assessed using several fit indices, including the chi-
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44 376 square (χ^2), the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean square
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46 377 error residual (RMSEA).^{69,70} The following approximate cut-off criteria were used, whereby CFI and
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48 378 TLI around .90⁶⁹ and a RMSEA value of $\leq .06$ ⁷⁰ indicate a good fit to the data⁷¹. Information criteria
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50 379 such as the Akaike information criterion (AIC) and the chi-square difference test were used for model
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52 380 comparison, whereby a model with a lower value indicates a more acceptable model fit.⁶⁹
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3 382 First, item characteristics, such as comments from participants or factor loadings, were considered to
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5 383 identify items for exclusion. Following this, five competing models were compared to test the
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7 384 hypothesized factor structure of the scale.^{69,72} In line with previous research, a second-order factor
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9 385 model is proposed for the active implementation leadership factors due to high factor
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11 386 correlations.^{18,33,38} The chi-square difference test was used to identify the best fitting model. Moreover,
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13 387 additional rigorous tests were performed by analysing a bifactor model to partition the variance of the
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15 388 multidimensional scales. Findings from the bifactor model were in line with the results from the CFA
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17 389 (see online Supplementary appendix 2 for analysis procedure and findings).

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22 392 Second, the reliability of each subscale was assessed via internal consistency (Cronbach's alpha).⁵⁹
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24 393 Convergent validity of implementation leadership was then analysed. Here, our scale was correlated
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26 394 with theoretically similar instruments,^{59,72} such as general transformational³³ and transactional
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28 395 leadership.¹⁸ Correlations should be higher than .40.⁷³ Discriminant validity was tested through the
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30 396 correlation of passive implementation leadership with general transformational and transactional
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32 397 leadership. For this, passive leadership was correlated with two constructs to which it should be
33
34 398 negatively related.⁵⁹ Lastly, the criterion-related validity^{59,72} was examined by performing regression
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36 399 models with implementation climate at Time 2 as the outcome, which is a theoretical outcome of
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38 400 implementation leadership.^{47,48} Multilevel modelling was used to account for the nestedness of the data
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40 401 (employees nested in workgroups) using Mplus 7.2 and maximum-likelihood estimation.⁷⁴ All
41
42 402 predictors were grand-mean centred before being entered in the model.⁷⁵ We expect a positive
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44 403 relation between active leadership at Time 1 and implementation climate at Time 2 when age, gender
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46 404 and education are controlled for. These relations were modelled on the individual level (Level 1).

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49 50 51 406 **Results**

52 53 54 407 *Examination of items and dimensionality*

408 Initial examination of the items when conducting the CFA resulted in the removal of four of the 20
 409 items. These items either did not capture the intended construct (factor loading < .4) or had low
 410 correlations ($r < .3$) with other items of the same construct,⁷⁶ and one of them was excluded due to
 411 participants commenting that it was difficult to understand, and thus to answer. Consequently, 16
 412 items were included for all further calculations.

413 To investigate the dimensionality of the scale (i.e. whether the subscales can be separated from each
 414 other), five competing models were compared. Description of the models and findings from these
 415 model comparisons are presented in Table 1. The results from the CFA showed that Model 1, our
 416 hypothesized model with four active implementation leadership subscales, was the best fitting model.
 417 That is, Models 2, 3, 4 and 5 fit the data significantly worse than Model 1, which had an acceptable
 418 model fit ($\chi^2_{(99)} = 382.864^{**}$, CFI=.935, TLI=.911, RMSEA=.059). Figure 1 displays the standardized
 419 factor loadings of this model.

421 **Table 1.** Model comparisons.

Models	χ^2	df	CFI	TLI	RMSEA	AIC	Model comparison	Δ df	$\Delta \chi^2$
Model 1	382.864**	99	.935	.911	.059	488.864			
Model 2	388.906**	100	.934	.911	.060	492.906	1 vs 2	1	6.04*
Model 3	452.720**	101	.920	.892	.065	554.720	2 vs 3	1	63.81**
Model 4	501.158**	103	.909	.880	.069	599.158	3 vs 4	2	48.44**
Model 5	1655.889**	170	.740	.678	.104	1775.889	4 vs 5	67	1154.73**

422 Note: N=336; ** $p < 0.01$; * $p < 0.05$.

423 *Model 1:* exemplary behaviours (EB), individualized consideration (IC), intellectual stimulation (IS), and contingent reward (CR) were
 424 included as four first-order factors under one second-order factor for active leadership (AL), and passive leadership (PL) was intercorrelated
 425 with AL; *Model 2:* IC and IS were collapsed into one factor, resulting in three first-order factors for the AL second-order factor, and PL was
 426 intercorrelated with AL; *Model 3:* EB, IC and IS were collapsed into one factor, resulting in two first-order factors for the AL second-order
 427 factor, and PL was intercorrelated with AL; *Model 4:* all the active factors (transformational leadership sub-factors and CR) were collapsed
 428 into one first-order factor, and PL was intercorrelated with AL; *Model 5:* all items loaded on one single factor.

429

430

431 --- **Figure 1 about here** ---

432

433 Hence, the final scale includes 16 items representing four active leadership subscales (i.e., *exemplary*
 434 *behaviours* (6 items), *individualized consideration* (2 items), *intellectual stimulation* (3 items), and
 435 *contingent reward* (2 items)) and passive leadership (3 items). Internal consistency was considered

436 satisfactory for all subscales ($\alpha > .70^{59}$). The final iLead scale, its constituent items, and internal
 437 consistency of the subscales are presented in Table 2.

438

439 **Table 2.** The iLead scale and internal consistency of subscales.

440	441	442	443	444	445	446	447	448	449
Scales and constituent items		α	Item no.						
1. Active implementation leadership		.95							
1a. Exemplary behaviours		.92							
<i>My closest manager...</i>									
...has shown determination to maintain the new working method			1						
...has talked about his/her values and beliefs of why it is important to work according to the new working method			2						
...has actively worked towards implementing the new working method			3						
...has continuously encouraged us in the implementation of the new working method			4						
...has behaved in a way that explicitly displays commitment to working according to the new working method			5						
...has been positive towards the implementation of the new working method			6						
1b. Individualized consideration		.80							
<i>My closest manager...</i>									
...has spent time showing me how I can work according to the new working method			7						
...has given me the opportunity to speak to him/her about what consequences the implementation of the new working method will have for me			8						
1c. Intellectual stimulation		.83							
<i>My closest manager...</i>									
...has done a lot to involve us in the implementation of the new working method			9						
...has encouraged me to express my ideas and opinions about implementing the new working method			10						
...has shared whatever information he/she has about the implementation of the new working method			11						
1d. Contingent reward		.85							
<i>My closest manager...</i>									
...has shown satisfaction when I work according to the new working method			12						
...has shown appreciation when we have achieved our goals to implement the new working method at our workplace			13						
2. Passive implementation leadership		.91							
<i>My closest manager...</i>									
...has avoided to intervene until major problems with the implementation of the new working method have arisen			14						
...has waited for things to go wrong with the implementation of the new working method before taking any action			15						
...has avoided making decisions that affect the implementation of the new working method			16						

Note: N=324–336, due to missing data on some items (pairwise deletion).

441

442

443 *Convergent and discriminant validity*

444 Bivariate correlations of all the measures in the present study and descriptive statistics are presented in

445 Table 3. To assess convergent validity, the correlations between active leadership and general

446 transformational and transactional leadership were calculated. Correlations between the sub-factors of

447 active and general transformational leadership ($r=.70 - .78^{**}$) and transactional leadership ($r=.61 -$

448 $.70^{**}$) were high, supporting convergent validity. To assess discriminant validity, the correlations

449 between passive leadership and general transformational and transactional leadership were calculated,

450 showing a correlation of $r=-.22^{**}$ with general transformational leadership and a correlation of $r=-.18^{**}$
 451 with transactional leadership. These results support discriminant validity.

452

453 **Table 3.** Bivariate correlations of study measures.

Scales	Mean	SD	1a	1b	1c	1d	2	3	4	5
1. Active implementation leadership	3.84	0.88								
1a. Exemplary behaviours	4.06	0.86								
1b. Individualized consideration	3.60	1.10	.73**							
1c. Intellectual stimulation	3.87	0.93	.87**	.84**						
1d. Contingent reward	3.84	0.97	.75**	.71**	.76**					
2. Passive implementation leadership	2.01	1.17	-.20**	-.12*	-.20**	-.17**				
3. General transformational leadership	3.87	0.93	.77**	.70**	.78**	.70**	-.22**			
4. General transactional leadership	3.79	0.97	.68**	.64**	.70**	.61**	-.18**	.86**		
5. Implementation climate	3.92	0.92	.34**	.37**	.27**	.45**	-.17*	.44**	.44**	

454 Note: N=158–649, due to missing data on some items (pairwise deletion); ** $p < 0.01$. Data was collected at Time 1 for all measures, except
 455 for Implementation climate, which was collected at Time 2.

456

457 *Criterion-related validity*

458 Criterion-related validity was tested by examining the relationship between implementation climate
 459 (measured at Time 2) and active and passive leadership at Time 1. In line with expectations, findings
 460 show that when age, gender and education were controlled for, active leadership significantly
 461 predicted implementation climate ($B=.40^*$). A slight negative relation that was not statistically
 462 significant ($B= -.07$) was observed between passive leadership and implementation climate (Table 4).

463

464 **Table 4.** Multilevel regressions: Implementation climate regressed on age, gender, education, and
 465 active and passive implementation leadership.

Predictor variables	Model 1	Model 2
	B (SE)	B (SE)
Age	.009*(.004)	-.01*(.01)
Gender (women)	.14 (.15)	.07 (.16)
University education	-.10 (.15)	.06 (.17)
Active implementation leadership		.40* (.08)
Passive implementation leadership		-.07 (.05)

466 Note: * $p < 0.05$; ICC=.15

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470 **Discussion**

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3 471 The aim of the present study was to adapt previous domain-specific scales to create and validate an
4 472 active and passive implementation-specific leadership scale that follows the factor structure of the
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6 473 FRLM – the iLead scale. The analyses supported good psychometric properties for the scale. Thus, the
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8 474 iLead scale can be used to assess how managers lead an implementation. This scale complements the
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10 475 knowledge about what leaders do and meets the need for a scale linking implementation leadership
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12 476 with theory. This is essential for uncovering how day-to-day leadership affects the implementation
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14 477 process.
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19 479 The predicted four subscales for active leadership and the scale for passive leadership were confirmed
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21 480 through CFA. Thus, analysis supports the existence of two distinct dimensions: active and passive
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23 481 leadership. As specified, active leadership was differentiated into four sub-factors: *exemplary*
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25 482 *behaviours, intellectual stimulation, individualized consideration and contingent reward* with a
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27 483 common second-order factor representing active leadership. This indicates that even though different
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29 484 sub-factors could be distinguished, they were all highly related, as captured in the second-order factor
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31 485 (i.e. active leadership). This is in line with previous studies in which a second-order factor has been
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33 486 used to capture the correlation between the sub-factors.^{19,33,38} These findings were also confirmed by
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35 487 the bifactor model. This analysis showed that the common factor of active leadership explained a large
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37 488 part of the variance, with a unique contribution of each of the four subscales. Similar to other
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39 489 theoretical constructs (e.g., intelligence or self-rated productivity), this means that each subscale
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41 490 reflects the common factor of active leadership to a larger extent than it reflects the subscales and
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43 491 should not be analysed independently without the common factor (Supplementary appendix 2).
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45 492 Nevertheless, since each sub-factor contributes with unique variance, they should still be distinguished
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47 493 in the model, and they can be used in the context of providing actionable feedback to managers in
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49 494 leadership training.^{18,27,35} In this context, the level of detail provided through the subscales help
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51 495 distinguish which specific sub-type of leader behaviours that need to improve. Thus, the iLead scale
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53 496 can be used in implementation training, for example to provide leaders with feedback and to evaluate
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55 497 the training, in addition to the research context.
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499 As anticipated, findings demonstrated that the passive leadership dimension is empirically distinct
500 from, although correlated with, the active one. This indicates that having a scale that represents the
501 continuum of leader behaviours in the same structural model is feasible for capturing both effective
502 and ineffective leader behaviours. In the present study, *passive management-by-exception* and *laissez-*
503 *faire* items represent the passive domain, considering their ineffective styles.^{18,20} To date, most
504 research has focused on active leader behaviours,^{15,16} despite the fact that both active and passive
505 leader behaviours influence employees and organizational outcomes.^{18,20,23} However, the importance
506 of also considering passive leader behaviours is receiving more research attention.^{20,21} For instance, a
507 study investigating the impact of safety-specific transformational and passive leadership on safety
508 outcomes demonstrated that the safety-specific passive leader behaviours had a negative effect on
509 outcomes (i.e. increased injury).²⁰ To date, implementation research has not focused on assessing
510 ineffective leader behaviours or investigated their influence on an implementation process. Through
511 the creation of the iLead scale, there is now a way to assess not only active, but also passive leadership
512 within the implementation context. This is an important next step, since passive behaviours may
513 actually have a negative impact when implementing change. The present study thereby adds to
514 existing knowledge of the overall effect of leadership on the implementation process. Consequently,
515 the iLead scale complements the existing Implementation Leadership Scale (ILS), which focuses on
516 measuring active implementation leadership.

517

518 The validity of the iLead scale was evaluated by investigating how it relates to other
519 measurements.^{59,72} Findings confirmed expected negative relations between the passive leadership and
520 general transformational³³ and transactional leadership.^{18,20} Moreover, the expected positive relations
521 between active implementation leadership with the general leadership scales were confirmed with
522 moderate to high correlations. This indicates that these measures belong to a similar latent construct,
523 but that the iLead scale also captures certain unique aspects of leadership. Furthermore, active
524 leadership predicted a higher implementation climate over time, whereas passive leadership was not

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3 525 significantly associated with implementation climate. This finding contradicts previous research that
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5 526 has found a negative correlation with passive leadership and specific climate.²⁰ Thus, this should be
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7 527 further explored in future studies. That active leadership predicts implementation climate is in line
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9 528 with implementation frameworks summarizing the process of implementation, for instance the
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11 529 Exploration, Preparation, Implementation and Sustainment (EPIS) model.⁷⁷ According to EPIS, active
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13 530 leadership should ultimately result in a favourable climate at the workplace, with employees
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15 531 perceiving implementation as part of the daily routine. These predictions have been confirmed in
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17 532 several empirical studies.^{45,78}

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22 534 A methodological aspect worth mentioning is that only those employees who could remember a
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24 535 specific implementation effort conducted at their workplace during the past six months were asked to
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26 536 respond to the iLead scale. Therefore, only 41% of the 815 eligible respondents answered the iLead
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28 537 scale. This aspect is perceived as informative, since leadership research has previously been criticized
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30 538 for assuming that employees have actually witnessed, and can therefore rate, the behaviour of their
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32 539 manager, which is not always the case.⁷⁹ Thus, to be particularly restrictive in evaluating this new
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34 540 measure, a filter variable was included in the questionnaire to ensure that employees actually had valid
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36 541 knowledge of their manager's implementation leader behaviour. It may be argued that those who
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38 542 answered these questions were those who could make a proper judgement about their manager's
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40 543 implementation leadership. The sample size was nonetheless still sufficient, as there were at least ten
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42 544 times more raters than questionnaire items in the analyses.⁶⁹

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47 546 The scale did not include *active management-by-exception* from the FRLM, which is described as the
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49 547 leader looking for mistakes and enforcing rules to avoid these mistakes.¹⁸ This was a result of certain
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51 548 problems associated with this construct. For instance, the operationalization of *active management-by-*
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53 549 *exception* is specifically troublesome since it often focuses only on negative control behaviours, such
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55 550 as stopping behaviours.⁵¹ This is despite the fact that it theoretically also includes positive control

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3 551 behaviours, such as monitoring and enforcing policies and routines, which show that the specific
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5 552 objective (e.g. implementation or safety) is an enacted priority.⁵¹ Moreover, the reliability of subscales
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7 553 aiming to capture *active management-by-exception* has been problematic.²³ Research has also
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9 554 indicated that, primarily, transformational leadership and contingent reward are those leader
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11 555 behaviours that result in positive effects.^{18,23} Consequently, the *active management-by-exception* factor
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13 556 was excluded from the iLead scale, which only incorporates the FRLM leadership dimensions that can
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15 557 be clearly distinguished into an overall active or passive implementation leadership category. This is
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17 558 in line with previously developed scales.^{20,49}

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22 560 Only three items were included to measure passive leadership. Although it is crucial to capture leader
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24 561 behaviours that may hinder an implementation process (passive leadership), it is even more valuable to
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26 562 capture those that have a positive effect on, and promote successful, implementation (active
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28 563 leadership), especially when using the scale in a leadership intervention as a source of feedback.
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30 564 Moreover, some sub-factors are represented by fewer than the recommended three items for new
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32 565 scales.⁸⁰ However, the iLead scale is based on the FRLM and previous domain-specific scales. In
33
34 566 addition, there are examples of brief and even single-items scales that have good psychometric
35
36 567 properties.⁵⁹ With the healthcare setting in mind when adapting and creating the iLead scale, the
37
38 568 ambition was to make it as pragmatic and feasible as possible to use in practice.⁸¹ Thus, the iLead
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40 569 scale is a brief, concise, and broadly applicable scale that may be used in the daily practice where
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42 570 continuous implementations are performed to improve patient outcomes.

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45 46 47 572 **Conclusions**

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49 573 This study describes a scale with good psychometric properties for measuring active and passive
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51 574 implementation leadership – the iLead scale. Including these aspects is relevant since both active and
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53 575 passive leader behaviours may influence employees' performance throughout an implementation
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55 576 process. More explicitly, the scale measures both what leaders do as well as how they perform these

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3 577 actions, through *exemplary behaviour, individualized consideration, intellectual stimulation* and
4 578 *contingent reward*, as well as *passive behaviours*. The iLead scale is based on the most widely applied
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6 579 leadership model, the FRLM, which makes the results relatable to a vast amount of research based on
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8 580 this theory. It also measures implementation-specific leadership in contrast to general leadership.
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10 581 Domain-specific leadership is associated with being more predictive for specific outcomes, such as
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12 582 implementation success, than general leadership. Thus, the iLead scale is a valid tool that can be used
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14 583 to understand how leader behaviours influence implementation success, and may be particularly
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16 584 valuable to apply in training implementation and evaluating leader training.
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22 586 **Abbreviations**

23
24 587 CFA: Confirmatory Factor Analysis

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27 588 COP: Co-created program theory

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29 589 EBP: Evidence-Based Practice

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32 590 FRLM: The Full-Range Leadership Model

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36 37 592 **Ethics approval and consent to publish**

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39 593 Ethical approval for the data collection was obtained from the local ethics committee in Stockholm,
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41 594 Sweden (ref no. 2015/857-31/5). Informed consent has been obtained from all participants included in
42
43 595 the present study.
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46 47 48 597 **Consent for publication**

49
50 598 Not applicable.

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54 55 56 600 **Availability of data and materials**

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3 601 Please contact author for data requests.
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5 602
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8 603 **Competing interests**
9

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11
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14

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27 612 **Authors' contributions**
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29
30 613 RM, AR, UvTS, HH and RL contributed to the theoretical background and study design. RM, AR,
31 UvTS and HH contributed to the item development. RM performed the data analysis, with
32 contributions from AR. For the present article, RM drafted the first version. All other authors
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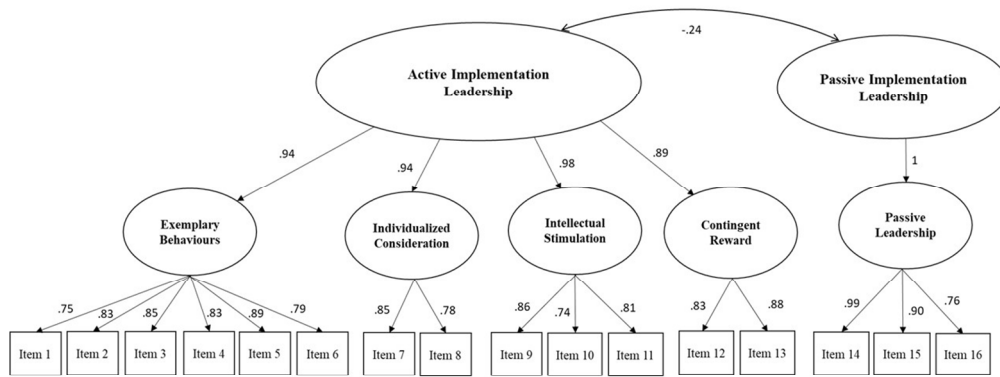


Figure 1. Standardized factor loadings for the iLead scale. † Note: n=336; All confirmatory factor analysis factor loadings are for Model 1 ($\chi^2(99)=382.864^{**}$, CFI=.935, TLI=.911, RMSEA=.059) with four first-order factors under one second-order factor for active implementation leadership, which is intercorrelated with a passive implementation leadership factor.

338x190mm (96 x 96 DPI)

Supplementary appendix 1: Items from the original domain-specific scales and the adapted items included in the iLead scale

Original items	Adapted items included in the iLead scale
<i>Kelloway et al</i> ¹	
Expresses satisfaction when I perform my job safely	My closest manager has shown satisfaction when I work according to the new working method
Makes sure that we receive appropriate rewards for achieving safety targets on the job	My closest manager has shown appreciation when we have achieved our goals to implement the new working method at our workplace
Provides continuous encouragement to do our jobs safely	My closest manager has continuously encouraged us in the implementation of the new working method
Shows determination to maintain a safe work environment	My closest manager has shown determination to maintain the new working method
Encourages me to express my ideas and opinion about safety at work	My closest manager has encouraged me to express my ideas and opinions about implementing the new working method
Talks about his/her values and beliefs of the importance of safety	My closest manager has talks about his/her values and beliefs of why it is important to work according the new working method
Behaves in a way that displays a commitment to a safe workplace	My closest manager has behaved in a way that explicitly displays commitment to working according to the new working method
Spends time showing me the safest way to do things at work	My closest manager has spent time showing me how I can work according to the new working method
Avoids making decisions that affect safety on the job	My closest manager has avoided making decisions that affect the implementation of the new working method
Fails to intervene until safety problems become serious	My closest manager has avoided to intervene until major problems with the implementation of the new working method has already arisen
Waits for things to go wrong before taking action	My closest manager has waited for things to go wrong with the implementation of the new working method before taking action
<i>Randall et al</i> ²	
My immediate manager has done a lot to involve employees throughout the process	My closest manager has done a lot to involve us in the implementation of the new working method
My immediate manager shared whatever he/she knew about the implementation of teams	My closest manager has shared whatever information he/she has about the implementation of the new working method
My immediate manager has actively worked towards the implementation of teams	My closest manager has actively worked towards implementing the new working method
My immediate manager was positive about the implementation of teams	My closest manager has been positive towards the implementation of the new working method
I have had the opportunity to speak with my immediate manager about which consequences the implementation of teams would have for me	My closest manager has given me the opportunity to speak to him/her about what consequences the implementation of the new working method will have for me

Note: In the iLead scale, 'the new working method' can be replaced with any initiative being implemented in a local setting.

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Supplementary appendix 2: Bifactor analysis to partition the variance of the multidimensional scales

Analysis procedure

The 13 indicators of active leadership were further analysed and modelled as a bifactor model using Mplus 7.2 using maximum-likelihood estimation.¹⁻³ Bifactor models can be used to partition the variance of multidimensional scales, differentiating the variance of each indicator into a common and unique component. The unique component can then further differentiate an indicator-specific and random error component. The bifactor model was composed of one general active leadership factor (i.e., all 13 indicators loading on the same factor) and four factors signifying the implementation leadership-specific sub-factors (i.e., *exemplary behaviour*, *individualized consideration*, *intellectual stimulation*, and *contingent reward*). Thus, all items loaded on two separate factors: the general active leadership factor and one implementation leadership-specific sub-factor. These five factors were uncorrelated with each other.¹ Based on the standardized factor loadings, omega (ω), omega hierarchical (ω_H), and omega subscale (ω_S) were calculated. Omega (ω) estimates the amount of variance in the observed scores that is due to a common factor variance (i.e., all sources of common variance); it corresponds to coefficient alpha for the total score. Omega hierarchical (ω_H) estimates the amount of total score variance that can be attributed to a single common factor (i.e., active implementation leadership), whereas omega subscale (ω_S) indicates the proportion of the reliable score variance of indicators measuring a specific factor (i.e., exemplary behaviour, individualized consideration, intellectual stimulation and contingent reward) after the general active implementation leadership factor is controlled for.¹ Hence, the Omega subscale (ω_S) is interpreted as the reliability of a specific sub-factor after the effect of other factors is controlled for. It is recommended that ω_S be at least .50 so that the specific sub-factor is sufficiently systematic to be interpreted separately.¹

Findings

Results from the bifactor model specifying the different variance components are presented in Table 1, where the standardized factor loadings (λ) for the common factor as well as the sub-factors are given.

The model fit ($\chi^2=25,922^*$, $df=55$, $RMSEA=.102$, $CFI=.945$, $SRMR=.033$) indicates mixed results, with some values above the recommended cut-off points. However, when fitting bifactor models the traditional fit indices may not be applicable, due to the use of polytomous items.⁴ Table 1 also presents the three omega (ω) coefficients, which are based on the standardized factor loadings (λ) retrieved from the bifactor model (see formulas 3, 4, and 6 in Reise et al., 2010¹). The general active implementation factor was reliable (ω estimate of .96), which indicates 96% of the variance in the observed scores was due to all sources of the common variance. Hence, there is a common factor showing systematic differences between individuals in active implementation leadership. The general active implementation leadership factor alone accounted for 92% of the variance ($\omega_H=0.92$), whereas the sub-dimensions of active implementation leadership show very low ω_H coefficients. Hence, the sub-factors are systematic but account for very small parts of the total variance of active implementation leadership. This interpretation is also strengthened by ω_S estimates, which indicate the proportion of reliable score variance of indicators measuring a specific sub-factor or perspective after the general active implementation leadership factor is controlled for. None of these ω_S values is near the cut-off value of 0.50, recommended by Reise et al., 2010.¹

Table 1. CFA bifactor model of active implementation leadership in the iLead scale.

	λ Active implementation leadership	λ Exemplary behaviours	λ Individualized consideration	λ Intellectual stimulation	λ Contingent reward
Item 1	.67*	.37*			
Item 2	.79*	.20*			
Item 3	.76*	.45*			
Item 4	.85*	.06			
Item 5	.84*	.27*			
Item 6	.70*	.46*			
Item 7	.80*		.26*		
Item 8	.74*		.26*		
Item 9	.83*			.14*	
Item 10	.76*			-.07	
Item 11	.78*			.62*	
Item 12	.75*				.39*
Item 13	.79*				.37*
ω	.96				
ω_H	.92	.02	.002	.004	.005
ω_S		.12	.08	.06	.16

Model fit: $\chi^2=25.922^*$; $df=55$; $RMSEA=.102$; $CFI=.945$; $SRMR=.033$

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How do iLead? Validation of a Scale Measuring Active and Passive Implementation Leadership in Swedish Healthcare

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How do iLead?

Validation of a Scale Measuring Active and Passive Implementation Leadership in Swedish Healthcare

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44 **Keywords:** implementation leadership, validation, scale, CFA, Full-Range Leadership Model
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47 **Word count:** 5361
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56 **Abstract**

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3 **Objectives:** This validation study aims to describe the creation of a scale – the iLead scale – through
4 adaptations of existing domain-specific scales that measure active and passive implementation
5 leadership, and to describe the psychometric properties of this scale.
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9 **Methods:** Data collected from a leadership intervention was used in this validation study.
10 Respondents were 336 healthcare professionals (90% female and 10% male; mean age 47 years)
11 whose first- and second-line managers participated in the intervention. The data was collected in the
12 Stockholm regional healthcare organization that offer primary, psychiatric, rehabilitation, and acute
13 hospital care, among other areas. The items for measuring implementation leadership were based on
14 existent research and the Full-Range Leadership Model. Confirmatory factor analysis was performed
15 to evaluate the dimensionality of the scale, followed by tests for reliability and convergent,
16 discriminant and criterion-related validity using correlations and multilevel regression analyses.
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25 **Results:** The final scale consists of 16 items clustered into four subscales representing active
26 implementation leadership, and one scale signifying passive implementation leadership. Findings
27 showed that the hypothesized model had an acceptable model fit ($\chi^2_{(99)} = 382.864^{**}$, CFI=.935,
28 TLI=.911, RMSEA=.059). The internal consistency and convergent, discriminant and criterion-related
29 validity were all satisfactory.
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36 **Conclusions:** The iLead scale is a valid measure of implementation leadership and is a tool for
37 understanding how active and passive leader behaviours influence an implementation process. This
38 brief scale may be particularly valuable to apply in training focusing on facilitating implementation,
39 and in evaluating leader training. Moreover, the scale can be useful in evaluating various leader
40 behaviours associated with implementation success or failure.
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50 **Strengths and limitations of this study**

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53 • The present study follows a rigorous validation process to explore the factor structure,
54 reliability and validity of the iLead scale.
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- Since the iLead scale is based on theory and other established scales, confirmatory factor analysis (CFA) was performed to confirm its suggested factor structure.
- Based on sample characteristics, the sample used for the validation represents a typical health care sample.
- Due to item deletion during the validation process, the different sub-scales in the iLead scale includes varying numbers of items.
- The response rate was moderate for the iLead scale, due to the use of a filter variable that assured that only respondents who could remember a specific implementation that their manager had led during the past six months were asked to respond to the iLead scale.

Introduction

Implementing change in healthcare is a complex and challenging task.^{1,2} Nonetheless, this effort is essential for keeping healthcare professionals up to date on, and ensuring their use of new research evidence so patients can receive the best possible care. Researchers have identified a wide range of contextual factors that influence effective implementation,³⁻⁵ one of which is leadership.⁶⁻⁸

Managers' behaviours during, an implementation are crucial for effectively achieving change in practice. This is particularly true for line managers (i.e. those with a managerial position closest to employees) who have a direct influence on employees' implementation behaviours.^{9,10} Research has recognized leadership behaviours such as being supportive, providing feedback, communicating clearly, being a role model, encouraging employee development and creating a context conforming to the implementation as essential in the implementation process (i.e., from needs assessment, preparation, implementation and to sustainability of the implementation¹¹).^{7,12-14} Moreover, managerial tasks, for instance planning, supervising change and providing resources, are also crucial to support implementation of change.¹⁵ Both these type of person and task related behaviours are central to influence change,¹⁶⁻¹⁸ and although some scholars make distinctions between management and leadership behaviours, others recognize that these behaviours sometimes overlap.¹⁹⁻²¹ This paper does

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3 not emphasize a distinction between management and leadership behaviours, but view both as
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5 complementary processes influencing a group of individuals that are essential for successful
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7 change.^{18,21} The scale validated in this study focuses on capturing line managers' implementation-
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9 specific leader behaviours – both what they do and how these actions are performed – based on the
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11 active and passive dimensions of the Full-Range Leadership Model. The theoretical perspective is
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13 expected to facilitate the understanding of both what managers do (e.g. provide information about the
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15 implementation) and how these actions are performed (e.g. if the information is provided in a way that
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17 inspires employees), thereby explaining the relationship between leadership and implementation
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19 outcomes.

20 21 22 23 24 **The Full-Range Leadership Model**

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26 The Full-Range Leadership Model (FRLM) is the most comprehensively researched approach to
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28 leadership.²²⁻²⁵ The model clusters leader behaviours into two broad dimensions signifying active and
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30 passive leadership.²⁵⁻²⁸ Transformational leadership is one factor of active leadership^{25,28} and is
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32 associated with beneficial individual and organizational outcomes,²⁹ employee performance,³⁰ the
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34 change process^{31,32} and organizational innovation³³ in various contexts and cultures.³⁴ There is also
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36 emerging evidence on the positive relationship between transformational leadership and effective
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38 implementation.¹⁰ For instance, transformational leadership has been strongly related to employees'
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40 innovation implementation behaviour³⁵ and their commitment to change.³⁶ Transformational leaders
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42 inspire employees to achieve higher goals and to perform at a higher level than expected. These leader
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44 behaviours were originally divided into three sub-factors: *idealized influence*, acting as a role model
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46 and building relationships with employees based on trust and respect; *individualized consideration*,
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48 coaching of staff and helping them develop, while conveying empathy for their needs and desires; and
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50 *intellectual stimulation*, encouraging employees to be creative and to challenge assumptions.²⁸
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52 *Inspirational motivation* was later added as another sub-factor to transformational leadership.^{20,37} This
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54 sub-factor concerns articulating a clear and compelling vision to employees and motivating them to
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56 achieve set goals.³⁷ It has been argued that these sub-factors are related, however it has proved
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3 problematic to distinguish between,^{25,37} mainly through difficulties in empirically supporting
4 discriminant validity (i.e. high intercorrelations).^{20,26,38,39} Consequently, different approaches to
5 conceptualize and measuring transformational leadership has been adopted. Some have measured it as
6 a global construct,^{33,39} whereas others have examined all individual sub-factors of transformational
7 leadership,^{40,41} and others have used a reduced set of factors.⁴² It has been especially difficult to
8 distinguish between *idealized influence* and *inspirational motivation*, both conceptually^{25,43} and
9 empirically.^{26,37,44} Thus, some have combined *idealized influence* and *inspirational motivation* into one
10 sub-factor.^{20,29,37,44,45}

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21 Another dimension of active leadership is *contingent reward*.^{26,28} This sub-factor is the most active
22 form of transactional leadership and involves an exchange relationship between manager and
23 employees, for instance setting mutually agreed-upon goals, and follow-up and linking them to
24 rewards. Contingent reward behaviours have been linked to employees' performance outcomes³⁰ and
25 satisfaction.²⁶ Current suggestions are that a combination of transformational leadership and
26 contingent reward is most effective in producing positive organizational outcomes.^{23,30,37,43,46} Based on
27 this, contingent reward is likely to be an important component of active implementation leadership.
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38 Passive leadership includes two dimensions.^{25,27,28} One of these is *passive management-by-exception*, a
39 sub-factor of transactional leadership.^{27,47} This refers to managerial behaviours related to acting first
40 when something has gone wrong, or correcting employee actions when these have been brought to
41 their attention. This sub-factor has been shown to be ineffective in achieving organizational outcomes,
42 such as safety at work,²⁷ and to negatively impact performance.³⁰ The other passive leadership
43 dimension is *laissez-faire leadership*, where leaders abdicate responsibility and avoid taking
44 initiative,²⁵ which has also shown to be ineffective for achieving positive outcomes,^{23,27} and is an
45 overall destructive leader behaviour.⁴⁸ *Passive management-by-exception* and *laissez-faire leadership*
46 have been combined in previous studies to represent a generalized passive leadership construct.^{25,27,34,47}
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3 These behaviours are typically highly correlated with each other and related to negative employee and
4 organizational outcomes, and negatively associated with active leadership.
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7 An additional sub-factor of the transactional leadership construct is *active management-by-exception*.⁴⁷
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9 This type of leader behaviour is characterized in terms of monitoring for and detecting mistakes that
10 deviate from the norm, and taking corrective action when errors occur.^{20,25} There is an ongoing
11 discussion as to whether *active management-by-exception* fits into the passive or the active categories
12 of leadership⁴⁷ or should be represented separately.⁴⁶ Some have shown that *active* and *passive*
13 *management-by-exception* are separate constructs that are either uncorrelated, or somewhat negatively
14 correlated.^{25,47} Comparing *active management-by-exception* to the active leadership dimensions, it is
15 more reactive than proactive and cannot be considered an effective leadership style. Therefore, *active*
16 *management-by-exception* was not included in this study.
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28 To date, leadership research has mostly focused on measuring active leader behaviours to identify
29 which ones are effective and positively influence organizational outcomes. However, capturing
30 passive leader behaviours that negatively influence employees is also of great importance, as these can
31 have disastrous consequences^{27,48,49} and will most likely influence the implementation process. The
32 research on implementation leadership has hitherto emphasized behaviours that are effective for
33 implementing change, naturally, since these are needed to achieve implementation success. However,
34 it is also important to consider and measure leader behaviours that may be disruptive to, and hinder, an
35 implementation process. This is important, since the way managers lead an implementation can
36 influence the implementation climate both positively and negatively.^{27,50} Implementation climate
37 involves employees' shared perceptions of an implementation initiative's practical value.⁵¹ Research
38 has demonstrated the relevance of implementation climate for the association between
39 transformational leadership and employees' commitment to change.³⁵ Moreover, active leadership may
40 also promote a positive implementation climate,^{52,53} and thus influence implementation success. This
41 highlights the importance of capturing both the active and passive aspects of leadership.^{25,27}
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Implementation-Specific Leadership

Recent research on leadership has indicated that leader behaviours directed at a particular initiative or objective, often referred to as domain-specific leadership,^{27,54,55} appear to be more effective than general leader behaviours for reaching the goals of this initiative. Consequently, general active leader behaviours do not seem to be sufficient for affecting a specific domain. In the areas of occupational safety,⁵⁶ employee health and well-being⁵⁷ and service climate,⁵⁵ this has led to the development of domain-specific FRLM-scales. Several of these scales build on the theory of the FRLM, however specifically ask the rater to consider leader behaviours in relation to a specific domain. When implementing changes in the healthcare context, this might mean that leader behaviours directed at a specific implementation initiative might be necessary for the success of the implementation process, rather than expecting general active leadership to have an impact. Hence, general leadership may foster a good work environment and performance overall, but may be insufficient for fostering implementation success for a specific evidence-based method to improve the delivery of healthcare. It is therefore necessary to measure leader behaviours specific to an implementation process. This also means that although there is a variety of theory-based scales that measure general leadership,²¹ these may not effectively predict the outcomes of an implementation process.^{58,59}

To date, there is one implementation-specific leadership scale: the Implementation Leadership Scale (ILS)⁶⁰ measures strategic leadership in the implementation of evidence-based practices (EBPs), and assesses active leader behaviours that promote implementation of EBPs.⁶⁰ We argue for three main reasons to construct a new scale to measure implementation leadership. First, no scale currently exists that measures active and passive leader behaviours in relation to implementation. This is an important aspect to be included in an implementation leadership scale since passive leader behaviours can have detrimental effects on employees,^{27,30} and consequently also for an implementation process. Second, although Aarons et al. (2014) considered the active leader behaviours of the FRLM when developing

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3 the ILS,⁶⁰ the aim was to assess independent and different aspects of implementation leadership. Thus,
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5 at present, no implementation leadership scale exists that operationalize the FRLM theory. We suggest
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7 that a scale measuring implementation leadership and maintains the FRLM structure is important for
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9 obtaining more detailed information about leader behaviours.⁴¹ Third, the ILS focuses on what
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11 managers do when leading implementation (e.g. developing a plan to facilitate the process) rather than
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13 how it is done (e.g. whether these tasks have been performed in a way that inspires employees). We
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15 suggest that an implementation leadership scale that, in addition to measuring what, measures how
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17 managers lead implementation is valuable for managers in their development as an implementation
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19 leader.
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24 In conclusion, the aim of this study is to adapt previous domain-specific scales^{27,61} to create and
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26 validate a scale that captures managers active and passive implementation-specific leadership
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28 behaviours, which follows the factor structure of the FRLM. The objective of the iLead scale is to
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30 complement a previous implementation leadership scale (ILS) by capturing both effective and
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32 disruptive implementation leader behaviours by basing the scale on the active and passive dimensions
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34 of the FRLM, and to capture what leaders do in addition to how they perform these behaviours. Four
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36 subscales are predicted for active implementation leadership and one subscale for passive
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38 implementation leadership.
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43 **Methods**

44 **Adapting previous domain-specific scales to construct the iLead scale**

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47 As a first step, a literature search was performed to identify key research relating to implementation
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49 leadership, including previously validated scales. This informed the decision that the scale should
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51 follow the factor structure of the FRLM, thus including both active and passive leader behaviours, and
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53 be adapted from existing scales. The basis for the construction of the iLead scale was two validated
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3 domain-specific leadership scales.^{27,54} We adapted the items from the scale developed by Kelloway et
4 al. (2006),²⁷ which measures transformational and passive safety leadership and follows the factor
5 structure of the FRLM, to be implementation specific. For instance, the original item ‘My manager
6 shows determination to maintain a safe work environment’ was adapted to ‘My manager has shown
7 determination to maintain the implementation of *the new working method*’. We complemented this
8 with the subscale ‘line managers’ attitudes and actions’ from the Intervention Process Measure (IPM)
9 by Randall et al. (2009).⁶¹ This scale specifically focuses on managerial behaviours in relation to
10 occupational health interventions and is one of the few widely used scales attempting to tap into leader
11 behaviours that occur in conjunction with a specific health intervention. The items were adapted
12 slightly to be applicable to the implementation area. This process resulted in a 20-item scale assessing
13 implementation-specific leadership.
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28 The iLead scale was developed as a tool to provide feedback for managers on their leader behaviours.
29 This scale was applied in an implementation leadership training intervention that aims to train
30 healthcare managers implementation leadership (the iLead intervention – please see the study protocol
31 for further details of this intervention⁶²), referred to as the ‘intervention’ throughout this study. It was
32 therefore important that the scale could distinguish between different types of active and passive
33 leader behaviours, as previously suggested.^{38,41} Hence, a differentiation between the factors was
34 sought. Although idealized influence and inspirational motivation may be argued to be conceptually
35 different,^{37,43} studies have not been able to consistently empirically separate these sub-factors.^{37,45}
36 Therefore, idealized influence and inspirational motivation were combined and called *exemplary*
37 *behaviours*, which is in line with previous studies using the FRLM.^{20,42,44} Consequently, the iLead
38 scale measures active implementation leadership, from here on referred to as active leadership,
39 through four subscales – the *exemplary behaviours* (7 items), *individualized consideration* (3 items),
40 *intellectual stimulation* (5 items) and *contingent reward* (2 items). Passive implementation leadership,
41 from here on referred to as passive leadership, comprises elements from both *passive management-by-*
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3 *exception* and *laissez-faire* leader behaviours (3 items), in line with a previous scale measuring
4 domain-specific leadership¹⁹.
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10 **Assurance of content validity**

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12 In addition to basing the iLead items on existing scales, two additional approaches were used to assure
13 content validity.⁶³ National experts in the field of leadership and implementation (n=5) and managers
14 in a healthcare organization (n=40) were invited to a workshop to identify crucial implementation
15 leader behaviours. This was performed using a structured and interactive process – the Co-created
16 program logic (COP).⁶⁴ The first step was to individually brainstorm leader behaviours perceived as
17 important in implementation, which were written on post-it notes. Thereafter, these notes with
18 different leader behaviours were attached to a whiteboard and the participants discussed these
19 behaviours together in groups and categorized them into overall themes. Examples of themes were:
20 ‘inspire and motivate employees’ and ‘be responsive to employees’ needs’. The themes that emerged
21 during this process were in line with scientific literature on effective leader behaviours when
22 implementing change. Third, to test the face validity of the scale,⁶³ employees and senior managers
23 (n=11) representing the healthcare organizations completed a draft of the questionnaire and were
24 asked for oral feedback on whether the items were clearly formulated, relevant and understandable,
25 and if they perceived that the scale measured the construct it aimed to measure. This did not lead to
26 any major changes to the items.
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45 **Participants**

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48 The data for the present study was collected as part of an implementation leadership training
49 intervention that was developed and evaluated in the Stockholm regional healthcare organization.⁶²
50 This organization offers primary, psychiatric, rehabilitation, and acute hospital care, among other
51 areas. The data used in the present study originates from the baseline measurement (Time 1),
52 conducted in November/December 2015, with the exception of one scale collected from the first
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3 follow-up (Time 2) in May/June 2016 to assess predictive criterion validity. All employees whose
4 managers were taking part in the iLead intervention and who were not on leave of absence, parental
5 leave, had quit their job, etc. were invited to participate in the study. Employee data was used since
6 managers' self-ratings are often inflated due to leniency bias,^{65,66} and previous studies have
7 demonstrated the validity of using employees' assessments of leader behaviours.^{67,68} Out of 1,084
8 eligible healthcare professionals, 815 responded (75% response rate) to the baseline measurement
9 (Time 1). Of these, 336 respondents (41%) answered the iLead scale. This was because a filter was
10 included at the beginning of the questionnaire to ensure that only respondents who could remember a
11 specific implementation responded to questions about their manager's implementation leadership.
12 They were instructed to replace the phrase '*the new working method*' in each question of the iLead
13 scale with the implementation they had identified in the filter question.
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28 The follow-up measurement was performed immediately after the implementation leadership training
29 intervention (Time 2),⁶² six months after the baseline measurement. The purpose of using data at Time
30 2 was to assess the predictive type of criterion validity (i.e. using a criterion that occurs in the
31 future).⁶³ Thus, data on implementation climate was used since active leadership is an important
32 predictor of a positive implementation climate.^{51,53} A total of 490 respondents answered the
33 questionnaire at Time 2, and 443 (90%) of these answered all the implementation climate items.
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43 The majority of respondents were female (90%) and had worked at their current job for two to five
44 years (26.8 %). All the managers were female. This is representative of the healthcare context in
45 Sweden.⁶⁹ The participants' mean age was 47 years (SD=11.8; Range: 22 – 65). Most participants,
46 79.6%, had obtained a university degree; 18.7% had finished high school; and 1.7% had no further
47 education, i.e. lower than a high school education.
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56 Procedure

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3 The respondents received a secured link to an electronic questionnaire through their work e-mail,
4 including information about the study and the purpose of the questionnaire. Two reminders were sent,
5 with a two-week time interval. All participants provided informed consent that their data could be used
6 in research, and confirmed that they understood that participation was voluntary and that they could
7 withdraw their participation at any time. The local ethics committee in Stockholm (ref no. 2015/857-
8 31/5) approved the data collection for the project.
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18 **Patient and public involvement**

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20 Important stakeholders (national experts, line managers and employees) were involved in this study as
21 described above (see Assurance of content validity). Patient's involvement was not applicable in this
22 study.
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30 **Measures**

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32 *Implementation-specific active and passive leadership* was measured through the iLead scale
33 (described above). All 20 items were scored on a 1 (strongly disagree) to 5 (strongly agree) Likert
34 scale.
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41 *Convergent and discriminant validity measures*

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43 *General transformational leadership* was measured through the Global Transformational Leadership
44 (GTL) scale³⁹ using seven items. An example item is: 'My closest manager communicates a clear and
45 positive vision of the future'. Items were scored on a 1 (strongly disagree) to 5 (strongly agree) Likert
46 scale. Cronbach's alpha was .95.
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52 *General transactional leadership* was measured through two items used in previous research that are
53 based on the Multifactor Leadership Questionnaire (MLQ), modified to be implementation-
54 specific.^{25,27} The items focus on contingent reward behaviours, for example: "My manager shows
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3 satisfaction when employees meet expectations”. Items were scored on a 1 (strongly disagree) to 5
4 (strongly agree) Likert scale. Cronbach’s alpha was .81.
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10 *Criterion-related validity measure*

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12 *Implementation climate* was measured with three items derived from the subscale ‘Focus on EBP’ of
13 the Implementation Climate Scale (ICS)⁵¹ (collected at Time 2). These items were deemed relevant for
14 assessing implementation climate due to their specific nature, and were therefore adapted to the
15 present study. For example, “Using evidence-based practices is a top priority in this team/agency” was
16 changed to “At my workplace it is a top priority to change our working methods in order to achieve
17 the best possible quality”. Items were scored on a 1 (strongly disagree) to 5 (strongly agree) Likert
18 scale. Cronbach’s alpha was .86.
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29 **Statistical analyses**

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31 Two major approaches were used to validate the scale.⁶³ Its dimensionality was evaluated through
32 confirmatory factor analysis (CFA) using AMOS 23. CFA was chosen over an exploratory factor
33 analysis (EFA) since the factor structure of the implementation-specific scale (i.e. FRLM) is well
34 established in the literature and has prior validity evidence.^{20,26,70,71} This is also in line with previous
35 studies of domain-specific scales based on the FRLM.²⁷ Thus, CFA is used to deductively confirm that
36 the data in the present study fits into the already proposed factor structure, whereas an EFA is more
37 inductive in its approach and should be used when developing new scales with items that have not
38 been tested in terms of reliability and validity.⁷² The maximum likelihood estimation (ML) approach
39 was used to address missing data values.⁷³ One path indicator for each latent variable was fixed to set
40 the scale of the latent variable. Model fit was assessed using several fit indices, including the chi-
41 square (χ^2), the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean square
42 error residual (RMSEA).^{73,74} The following approximate cut-off criteria were used, whereby CFI and
43 TLI around .90⁷³ and a RMSEA value of $\leq .06$ ⁷⁴ indicate a good fit to the data.⁷⁵ Information criteria
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3 such as the Akaike information criterion (AIC) and the chi-square difference test were used for model
4 comparison, whereby a model with a lower value indicates a more acceptable model fit.⁷³
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10 First, item characteristics, such as comments from participants or factor loadings, were considered to
11 identify items for exclusion. Following this, five competing models were compared to test the
12 hypothesized factor structure of the scale.^{73,76} In line with previous research, a second-order factor
13 model is proposed for the active implementation leadership factors due to high factor
14 correlations.^{25,39,44} The chi-square difference test was used to identify the best fitting model. Moreover,
15 additional rigorous tests were performed by analysing a bifactor model to partition the variance of the
16 multidimensional scales. Findings from the bifactor model were in line with the results from the CFA.
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27 Second, the reliability of each subscale was assessed via internal consistency (Cronbach's alpha).⁶³
28 Convergent validity of implementation leadership was then analysed. Here, our scale was correlated
29 with theoretically similar instruments,^{63,76} such as general transformational³⁹ and transactional
30 leadership.^{25,27} Correlations should be higher than .40.⁷⁷ Discriminant validity was tested through the
31 correlation of passive implementation leadership with general transformational and transactional
32 leadership. For this, passive leadership was correlated with two constructs to which it should be
33 negatively related.⁶³ Lastly, the criterion-related validity^{63,76} was examined by performing regression
34 models with implementation climate at Time 2 as the outcome, which is a theoretical outcome of
35 implementation leadership.^{52,53} Multilevel modelling was used to account for the nestedness of the data
36 (employees nested in workgroups) using Mplus 7.2 and maximum-likelihood estimation.⁷⁸ All
37 predictors were grand-mean centred before being entered in the model.⁷⁹ We expect a positive
38 relation between active leadership at Time 1 and implementation climate at Time 2 when age, gender
39 and education are controlled for. These relations were modelled on the individual level (Level 1).
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56 **Results**

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Examination of items and dimensionality

Initial examination of the items when conducting the CFA resulted in the removal of four of the 20 items. These items either did not capture the intended construct (factor loading < .4) or had low correlations ($r < .3$) with other items of the same construct,⁸⁰ and one of them was excluded due to participants commenting that it was difficult to understand, and thus to answer. Consequently, 16 items were included for all further calculations.

To investigate the dimensionality of the scale (i.e. whether the subscales can be separated from each other), five competing models were compared. Description of the models and findings from these model comparisons are presented in Table 1. The results from the CFA showed that Model 1, our hypothesized model with four active implementation leadership subscales, was the best fitting model. That is, Models 2, 3, 4 and 5 fit the data significantly worse than Model 1, which had an acceptable model fit ($\chi^2_{(99)} = 382.864^{**}$, CFI=.935, TLI=.911, RMSEA=.059). Figure 1 displays the standardized factor loadings of this model.

Table 1. Model comparisons.

Models	χ^2	df	CFI	TLI	RMSEA	AIC	Model comparison	Δ df	$\Delta \chi^2$
Model 1	382.864**	99	.935	.911	.059	488.864			
Model 2	388.906**	100	.934	.911	.060	492.906	1 vs 2	1	6.04*
Model 3	452.720**	101	.920	.892	.065	554.720	2 vs 3	1	63.81**
Model 4	501.158**	103	.909	.880	.069	599.158	3 vs 4	2	48.44**
Model 5	1655.889**	170	.740	.678	.104	1775.889	4 vs 5	67	1154.73**

Notes: N=336; ** p < 0.01; * p < 0.05.

Model 1: exemplary behaviours (EB), individualized consideration (IC), intellectual stimulation (IS), and contingent reward (CR) were included as four first-order factors under one second-order factor for active leadership (AL), and passive leadership (PL) was intercorrelated with AL; *Model 2:* IC and IS were collapsed into one factor, resulting in three first-order factors for the AL second-order factor, and PL was intercorrelated with AL; *Model 3:* EB, IC and IS were collapsed into one factor, resulting in two first-order factors for the AL second-order factor, and PL was intercorrelated with AL; *Model 4:* all the active factors (transformational leadership sub-factors and CR) were collapsed into one first-order factor, and PL was intercorrelated with AL; *Model 5:* all items loaded on one single factor.

--- Figure 1 about here ---

Hence, the final scale includes 16 items representing four active leadership subscales (i.e., *exemplary behaviours* (6 items), *individualized consideration* (2 items), *intellectual stimulation* (3 items), and *contingent reward* (2 items) and passive leadership (3 items). Internal consistency was considered satisfactory for all subscales ($\alpha > .70^{63}$). The final iLead scale, its constituent items, and internal consistency of the subscales are presented in Table 2.

Table 2. The iLead scale and internal consistency of subscales.

Scales and constituent items	α	Item no.
1. Active implementation leadership	.95	
1a. Exemplary behaviours	.92	
<i>My closest manager...</i>		
...has shown determination to maintain the new working method		1
...has talked about his/her values and beliefs of why it is important to work according to the new working method		2
...has actively worked towards implementing the new working method		3
...has continuously encouraged us in the implementation of the new working method		4
...has behaved in a way that explicitly displays commitment to working according to the new working method		5
...has been positive towards the implementation of the new working method		6
1b. Individualized consideration	.80	
<i>My closest manager...</i>		
...has spent time showing me how I can work according to the new working method		7
...has given me the opportunity to speak to him/her about what consequences the implementation of the new working method will have for me		8
1c. Intellectual stimulation	.83	
<i>My closest manager...</i>		
...has done a lot to involve us in the implementation of the new working method		9
...has encouraged me to express my ideas and opinions about implementing the new working method		10
...has shared whatever information he/she has about the implementation of the new working method		11
1d. Contingent reward	.85	
<i>My closest manager...</i>		
...has shown satisfaction when I work according to the new working method		12
...has shown appreciation when we have achieved our goals to implement the new working method at our workplace		13
2. Passive implementation leadership	.91	
<i>My closest manager...</i>		
...has avoided to intervene until major problems with the implementation of the new working method have arisen		14
...has waited for things to go wrong with the implementation of the new working method before taking any action		15
...has avoided making decisions that affect the implementation of the new working method		16

Notes: N=324–336, due to missing data on some items (pairwise deletion).

Convergent and discriminant validity

Bivariate correlations of all the measures in the present study and descriptive statistics are presented in Table 3. To assess convergent validity, the correlations between active leadership and general transformational and transactional leadership were calculated. Correlations between the sub-factors of active and general transformational leadership ($r=.70 - .78^{**}$) and transactional leadership ($r=.61 -$

.70**) were high, supporting convergent validity. To assess discriminant validity, the correlations between passive leadership and general transformational and transactional leadership were calculated, showing a correlation of $r = -.22^{**}$ with general transformational leadership and a correlation of $r = -.18^{**}$ with transactional leadership. These results support discriminant validity.

Table 3. Bivariate correlations of study measures.

Scales	Mean	SD	1a	1b	1c	1d	2	3	4	5
1. Active implementation leadership	3.84	0.88								
1a. Exemplary behaviours	4.06	0.86								
1b. Individualized consideration	3.60	1.10	.73**							
1c. Intellectual stimulation	3.87	0.93	.87**	.84**						
1d. Contingent reward	3.84	0.97	.75**	.71**	.76**					
2. Passive implementation leadership	2.01	1.17	-.20**	-.12*	-.20**	-.17**				
3. General transformational leadership	3.87	0.93	.77**	.70**	.78**	.70**	-.22**			
4. General transactional leadership	3.79	0.97	.68**	.64**	.70**	.61**	-.18**	.86**		
5. Implementation climate	3.92	0.92	.34**	.37**	.27**	.45**	-.17*	.44**	.44**	

Notes: N=158–649, due to missing data on some items (pairwise deletion); ** $p < 0.01$. * $p < 0.05$. Data was collected at Time 1 for all measures, except for Implementation climate, which was collected at Time 2.

Criterion-related validity

Criterion-related validity was tested by examining the relationship between implementation climate (measured at Time 2) and active and passive leadership at Time 1. In line with expectations, findings show that when age, gender and education were controlled for, active leadership significantly predicted implementation climate ($B = .40^*$). A slight negative relation that was not statistically significant ($B = -.07$) was observed between passive leadership and implementation climate (Table 4).

Table 4. Multilevel regressions: Implementation climate regressed on age, gender, education, and active and passive implementation leadership.

	Model 1	Model 2
Predictor variables	B (SE)	B (SE)
Age	.009* (.004)	-.01* (.01)
Gender (women)	.14 (.15)	.07 (.16)
University education	-.10 (.15)	.06 (.17)
Active implementation leadership		.40* (.08)
Passive implementation leadership		-.07 (.05)

Notes: * $p < 0.05$; ICC=.15

Discussion

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3 The aim of the present study was to adapt previous domain-specific scales to create and validate an
4 active and passive implementation-specific leadership scale that follows the factor structure of the
5 FRLM – the iLead scale. The analyses supported good psychometric properties for the scale. Thus, the
6 iLead scale can be used to assess how managers lead an implementation. This scale complements the
7 knowledge about what leaders do and meets the need for a scale linking implementation leadership
8 with theory. This is essential for uncovering how day-to-day leadership affects the implementation
9 process.
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19 The predicted four subscales for active leadership and the scale for passive leadership were confirmed
20 through CFA. Thus, analysis supports the existence of two distinct dimensions: active and passive
21 leadership. As specified, active leadership was differentiated into four sub-factors: *exemplary*
22 *behaviours*, *intellectual stimulation*, *individualized consideration* and *contingent reward* with a
23 common second-order factor representing active leadership. This indicates that even though different
24 sub-factors could be distinguished, they were all highly related, as captured in the second-order factor
25 (i.e. active leadership). This is in line with previous studies in which a second-order factor has been
26 used to capture the correlation between the sub-factors.^{26,39,44} These findings were also confirmed by
27 the bifactor model. This analysis showed that the common factor of active leadership explained a large
28 part of the variance, with a unique contribution of each of the four subscales. Similar to other
29 theoretical constructs (e.g., intelligence or self-rated productivity), this means that each subscale
30 reflects the common factor of active leadership to a larger extent than it reflects the subscales and
31 should not be analysed independently without the common factor (see Supplementary appendix).
32 Nevertheless, since each sub-factor contributes with unique variance, they should still be distinguished
33 in the model, and they can be used in the context of providing actionable feedback to managers in
34 leadership training.^{25,34,41} In this context, the level of detail provided through the subscales help
35 distinguish which specific sub-type of leader behaviours that need to improve. Thus, the iLead scale
36 can be used in implementation training, for example to provide leaders with feedback and to evaluate
37 the training, in addition to the research context.
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5 As anticipated, findings demonstrated that the passive leadership dimension is empirically distinct
6 from, although correlated with, the active one. This indicates that having a scale that represents the
7 continuum of leader behaviours in the same structural model is feasible for capturing both effective
8 and ineffective leader behaviours. In the present study, *passive management-by-exception* and *laissez-*
9 *faire* items represent the passive domain, considering their ineffective styles.^{25,27} To date, most
10 research has focused on active leader behaviours,^{22,23} despite the fact that both active and passive
11 leader behaviours influence employees and organizational outcomes.^{25,27,30} However, the importance
12 of also considering passive leader behaviours is receiving more research attention.^{27,28} For instance, a
13 study investigating the impact of safety-specific transformational and passive leadership on safety
14 outcomes demonstrated that the safety-specific passive leader behaviours had a negative effect on
15 outcomes (i.e. increased injury).²⁷ Thus far, implementation research has not focused on assessing
16 ineffective leader behaviours or investigated their influence on an implementation process. Through
17 the creation of the iLead scale, there is now an approach to assess not only active, but also passive
18 leadership within the implementation context. This is an important next step, since passive behaviours
19 may actually have a negative impact when implementing change. The present study thereby adds to
20 existing knowledge of the overall effect of leadership on the implementation process. Consequently,
21 the iLead scale complements the existing Implementation Leadership Scale (ILS), which focuses on
22 measuring active implementation leadership.
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44 The validity of the iLead scale was evaluated by investigating how it relates to other
45 measurements.^{63,76} Findings confirmed expected negative relations between the passive leadership and
46 general transformational³⁹ and transactional leadership.^{25,27} Moreover, the expected positive relations
47 between active implementation leadership with the general leadership scales were confirmed with
48 moderate to high correlations. This indicates that these measures belong to a similar latent construct,
49 but that the iLead scale also captures certain unique aspects of leadership. Furthermore, active
50 leadership predicted a higher implementation climate over time, whereas passive leadership was not
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2 significantly associated with implementation climate. This finding contradicts previous research that
3 has found a negative correlation with passive leadership and specific climate.²⁷ Thus, this should be
4 further explored in future studies. That active leadership predicts implementation climate is in line
5 with implementation frameworks summarizing the process of implementation, for instance the
6 Exploration, Preparation, Implementation and Sustainment (EPIS) model.⁸¹ According to EPIS, active
7 leadership should ultimately result in a favourable climate at the workplace, with employees
8 perceiving implementation as part of the daily routine. These predictions have been confirmed in
9 several empirical studies.^{50,82}

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21 A methodological aspect worth mentioning is that only those employees who could remember a
22 specific implementation effort conducted at their workplace during the past six months were asked to
23 respond to the iLead scale. Therefore, only 41% of the 815 eligible respondents answered the iLead
24 scale. This aspect is perceived as informative, since leadership research has previously been criticized
25 for assuming that employees have actually witnessed, and can therefore rate, the behaviour of their
26 manager, which is not always the case.⁸³ Thus, to be particularly restrictive in evaluating this new
27 measure, a filter variable was included in the questionnaire to ensure that employees actually had valid
28 knowledge of their manager's implementation leader behaviour. It may be argued that those who
29 answered these questions were those who could make a proper judgement about their manager's
30 implementation leadership. The sample size was nonetheless still sufficient, as there were at least ten
31 times more raters than questionnaire items in the analyses.⁷³

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47 The scale did not include *active management-by-exception* from the FRLM, which is described as the
48 leader looking for mistakes and enforcing rules to avoid these mistakes.²⁵ This was a result of certain
49 problems associated with this construct. For instance, the operationalization of *active management-by-*
50 *exception* is specifically troublesome since it often focuses only on negative control behaviours, such
51 as stopping behaviours.⁵⁶ This is despite the fact that it theoretically also includes positive control
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3 behaviours, such as monitoring and enforcing policies and routines, which show that the specific
4 objective (e.g. implementation or safety) is an enacted priority.⁵⁶ Moreover, the reliability of subscales
5 aiming to capture *active management-by-exception* has been problematic.³⁰ Research has also
6 indicated that it is primarily transformational leadership and contingent reward that result in positive
7 effects.^{25,30} Consequently, the *active management-by-exception* factor was excluded from the iLead
8 scale, which only incorporates the FRLM leadership dimensions that can be clearly distinguished into
9 an overall active or passive implementation leadership category. This is in line with previously
10 developed scales.^{27,54}

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21 Only three items were included to measure passive leadership. Although it is crucial to capture leader
22 behaviours that may hinder an implementation process (passive leadership), it is even more valuable to
23 capture those that have a positive effect on, and promote successful, implementation (active
24 leadership), especially when using the scale in a leadership intervention as a source of feedback.
25 Moreover, some sub-factors are represented by fewer than the recommended three items for new
26 scales.⁸⁴ However, the iLead scale is based on the FRLM and previous domain-specific scales. In
27 addition, there are examples of brief and even single-items scales that have good psychometric
28 properties.⁶³ With the healthcare setting in mind when tailoring and creating the iLead scale, the
29 ambition was to make it as pragmatic and feasible as possible to use in practice.⁸⁵ Thus, the iLead
30 scale is a brief, concise, and broadly applicable scale that may be used in the daily practice where
31 continuous implementations are performed to improve patient outcomes.

32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 **Conclusions**

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49 This study describes a scale with good psychometric properties for measuring active and passive
50 implementation leadership – the iLead scale. Including these aspects is relevant since both active and
51 passive leader behaviours may influence employees' performance throughout an implementation
52 process. More explicitly, the scale measures both what leaders do as well as how they perform these
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2 actions, through *exemplary behaviour, individualized consideration, intellectual stimulation and*
3 *contingent reward, and passive behaviours*. The iLead scale is based on the most widely applied
4 leadership model, the FRLM, which makes the results relatable to a vast amount of research based on
5 this theory. It also measures implementation-specific leadership in contrast to general leadership.
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7 Domain-specific leadership is associated with being more predictive for specific outcomes, such as
8 implementation success, than general leadership. Thus, the iLead scale is a valid tool that can be used
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10 to understand how leader behaviours influence implementation success, and may be particularly
11 valuable to apply in training implementation and evaluating leader training.
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22 **Abbreviations**

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24 CFA: Confirmatory Factor Analysis

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26 COP: Co-created program theory

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28 EBP: Evidence-Based Practice

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30 FRLM: The Full-Range Leadership Model
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38 **Ethics approval and consent to publish**

39 Ethical approval for the data collection was obtained from the local ethics committee in Stockholm,
40 Sweden (ref no. 2015/857-31/5). Informed consent has been obtained from all participants included in
41 the present study.
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48 **Consent for publication**

49 Not applicable.
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56 **Data sharing statement**

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3 This study presents all the items used to measure implementation leadership. Please contact the
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5 corresponding author for data requests.
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10 **Competing interests**

11
12 The authors declare that they have no competing interests.
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30 **Authors' contributions**

31
32 RM, AR, UvTS, HH and RL contributed to the theoretical background and study design. RM, AR,
33
34 UvTS and HH contributed to the item development. RM performed the data analysis, with
35
36 contributions from AR. For the present article, RM drafted the first version. All other authors
37
38 contributed to writing and editing all parts of the article. All authors have approved the final version.
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13 **Figure title and legend section**
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16 **Figure 1. Standardized factor loadings for the iLead scale.**
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19 Notes: n=336; All confirmatory factor analysis factor loadings are for Model 1 ($\chi^2_{(99)}=382.864^{**}$, CFI=.935, TLI=.911,
20 RMSEA=.059) with four first-order factors under one second-order factor for active implementation leadership, which is
21 intercorrelated with a passive implementation leadership factor.
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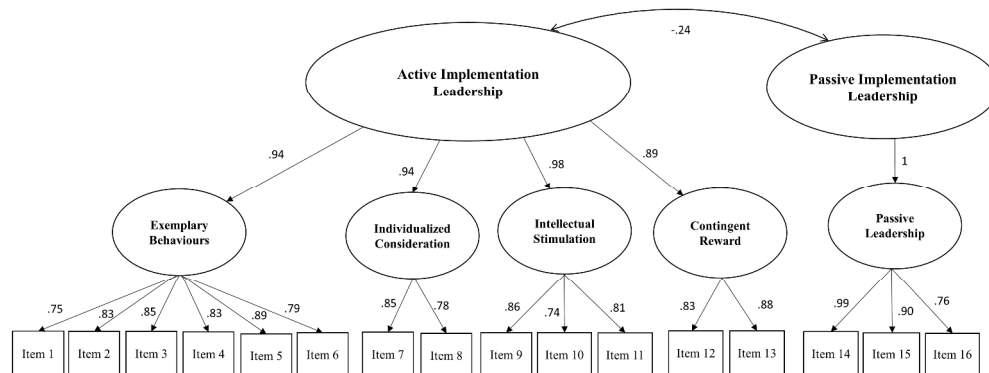


Figure 1. Standardized factor loadings for the iLead scale. † † † †

Notes: n=336; All confirmatory factor analysis factor loadings are for Model 1 ($\chi^2(99)=382.864^{**}$, CFI=.935, TLI=.911, RMSEA=.059) with four first-order factors under one second-order factor for active implementation leadership, which is intercorrelated with a passive implementation leadership factor.

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Supplementary appendix 2: Bifactor analysis to partition the variance of the multidimensional scales

Analysis procedure

The 13 indicators of active leadership were further analysed and modelled as a bifactor model using Mplus 7.2 using maximum-likelihood estimation.¹⁻³ Bifactor models can be used to partition the variance of multidimensional scales, differentiating the variance of each indicator into a common and unique component. The unique component can then further differentiate an indicator-specific and random error component. The bifactor model was composed of one general active leadership factor (i.e., all 13 indicators loading on the same factor) and four factors signifying the implementation leadership-specific sub-factors (i.e., *exemplary behaviour*, *individualized consideration*, *intellectual stimulation*, and *contingent reward*). Thus, all items loaded on two separate factors: the general active leadership factor and one implementation leadership-specific sub-factor. These five factors were uncorrelated with each other.¹ Based on the standardized factor loadings, omega (ω), omega hierarchical (ω_H), and omega subscale (ω_S) were calculated. Omega (ω) estimates the amount of variance in the observed scores that is due to a common factor variance (i.e., all sources of common variance); it corresponds to coefficient alpha for the total score. Omega hierarchical (ω_H) estimates the amount of total score variance that can be attributed to a single common factor (i.e., active implementation leadership), whereas omega subscale (ω_S) indicates the proportion of the reliable score variance of indicators measuring a specific factor (i.e., exemplary behaviour, individualized consideration, intellectual stimulation and contingent reward) after the general active implementation leadership factor is controlled for.¹ Hence, the Omega subscale (ω_S) is interpreted as the reliability of a specific sub-factor after the effect of other factors is controlled for. It is recommended that ω_S be at least .50 so that the specific sub-factor is sufficiently systematic to be interpreted separately.¹

Findings

Results from the bifactor model specifying the different variance components are presented in Table 1, where the standardized factor loadings (λ) for the common factor as well as the sub-factors are given.

The model fit ($\chi^2=25,922^*$, $df=55$, $RMSEA=.102$, $CFI=.945$, $SRMR=.033$) indicates mixed results, with some values above the recommended cut-off points. However, when fitting bifactor models the traditional fit indices may not be applicable, due to the use of polytomous items.⁴ Table 1 also presents the three omega (ω) coefficients, which are based on the standardized factor loadings (λ) retrieved from the bifactor model (see formulas 3, 4, and 6 in Reise et al., 2010¹). The general active implementation factor was reliable (ω estimate of .96), which indicates 96% of the variance in the observed scores was due to all sources of the common variance. Hence, there is a common factor showing systematic differences between individuals in active implementation leadership. The general active implementation leadership factor alone accounted for 92% of the variance ($\omega_H=0.92$), whereas the sub-dimensions of active implementation leadership show very low ω_H coefficients. Hence, the sub-factors are systematic but account for very small parts of the total variance of active implementation leadership. This interpretation is also strengthened by ω_S estimates, which indicate the proportion of reliable score variance of indicators measuring a specific sub-factor or perspective after the general active implementation leadership factor is controlled for. None of these ω_S values is near the cut-off value of 0.50, recommended by Reise et al., 2010.¹

Table 1. CFA bifactor model of active implementation leadership in the iLead scale.

	λ Active implementation leadership	λ Exemplary behaviours	λ Individualized consideration	λ Intellectual stimulation	λ Contingent reward
Item 1	.67*	.37*			
Item 2	.79*	.20*			
Item 3	.76*	.45*			
Item 4	.85*	.06			
Item 5	.84*	.27*			
Item 6	.70*	.46*			
Item 7	.80*		.26*		
Item 8	.74*		.26*		
Item 9	.83*			.14*	
Item 10	.76*			-.07	
Item 11	.78*			.62*	
Item 12	.75*				.39*
Item 13	.79*				.37*
ω	.96				
ω_H	.92	.02	.002	.004	.005
ω_S		.12	.08	.06	.16

Model fit: $\chi^2=25.922^*$; $df=55$; $RMSEA=.102$; $CFI=.945$; $SRMR=.033$

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