

TITLE PAGE

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2 Title of the article

3 A Self-Monitoring Wellbeing Screening Methodology for Keyworkers, 'My Personal
4 Wellbeing', using an Integrative Wellbeing Model

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24

25 ABSTRACT

26 **Background** The detrimental impact of Covid-19 has led to an urgent need to support the wellbeing
27 of UK National Health Service and care workers. This research develops an online diary to support
28 the wellbeing of staff in public healthcare in real-time, allowing the exploration of population
29 wellbeing and pro-active responses to issues identified.

30 **Methods** The diary was co-produced by NHS and care stakeholders and university researchers. It
31 was based on an integrative model monitoring mental health symptoms as well as wellbeing
32 indicators. Diary users were encouraged to reflect on their experience confidentially, empowering
33 them to monitor their wellbeing. The data collected was analysed using Mann-Whitney-Wilcoxon
34 and Kruskal-Wallis statistical tests to determine any significant wellbeing trends and issues.

35 **Results** A statistically significant decline in wellbeing ($P < 2.2E-16$), and a significant increase in
36 symptoms ($P = 1.2E-14$) was observed. For example, indicators of post-traumatic stress, including,
37 flashbacks, dissociation, and bodily symptoms (Kruskal-Wallis $P = 0.00081$, 0.0083 , and 0.027 ,
38 respectively) became significantly worse and users reported issues with sleeping (51%), levels of
39 alertness (46%), and burnout (41%).

40 Conclusions

41 The wellbeing diary indicated the value of providing ways to distinguish trends and wellbeing
42 problems, thus, informing how staff wellbeing services can determine and respond to need with
43 timely interventions. The results particularly emphasised the pressing need for interventions that
44 help staff with burnout, self-compassion, and intrusive memories.

45 Keywords

46 Staff health, wellbeing, integrative wellbeing model, self-monitoring, reflective diary, healthcare,
47 Covid-19

48 BACKGROUND

49 The recent pandemic of a respiratory virus has posed a significant challenge to the mental health of
50 nations, [1]. Part of the resilience of the nation is based on the capacity of its essential services to
51 continue to function, particularly healthcare. In the UK, there was a concern that the strain of the
52 pandemic may have a detrimental impact on staff wellbeing and both system and personal
53 'resilience'. As part of a compassionate response to health workers and key workers, systems
54 needed to be set up to support them. The scope of this new support task was to address any specific
55 psychological disorders that were an understandable response to the challenges. Traditional models
56 of mental health services would screen for disorder and have data on this held by health support
57 services. However, wellbeing is a broader concept of mental health that considers strengths and
58 functioning as well as symptoms. A support service for staff based around wellbeing could work on
59 prevention, address systemic leadership and organisational aspects of mental health, deal with the
60 complexity of the struggles of our colleagues and address 'disorders'. Self-monitoring was thought to
61 be one way of contributing to such a model. It can aid mindful awareness and empowered choices
62 about when to seek help. Such a model fits better with the concept of trauma informed care that
63 seeks to understand mental health 'problems' as survival strategies to a particular context and sees
64 mental health as related to empowerment, linked to personally meaningful goals and based on
65 compassionate, mutual relationships, [2]. This diary emerged from that context, where a regional
66 NHS staff wellbeing hub aspired to develop a service for NHS and social care staff based on
67 empowering and non-stigmatising principles from that available in mainstream mental health
68 services or occupational health teams. That required a novel way of screening staff with focus on
69 self-monitoring of wellbeing rather than mental health diagnosis and a need was identified to
70 develop a diary tool, "My Personal Wellbeing", to provide people with an anonymous means for
71 monitoring their wellbeing in real time. The diary data could also contribute to an agile service able
72 to respond to staff issues in a proactive way. The tool aims to: determine which factors affect
73 wellbeing; identify the aspects of wellbeing that are improving / declining; identify the aspects of

74 wellbeing that correlate together and may indicate more serious health situations. The diary
75 integrates both mental health symptoms tracking as well as wellbeing indicators monitoring, while
76 similar interventions categorised in the literature typically monitor either symptoms or wellbeing
77 indicators, not both [3, 4, 5]. The choice of combining mental health symptoms and wellbeing
78 indicators monitoring was intentional, in order to allow for exploring correlations between changes
79 in symptoms and wellbeing indicators.

80

81 The pandemic has had a significant impact on staff. A meta-analysis on the impact on staff mental
82 health during pandemics (n=38 studies) reported that staff with face-to-face contact with affected
83 patients had greater levels of both acute and post traumatic and stress and psychological distress
84 when compared to lower risk controls, [6]. Similarly, frontline workers in the UK during covid had
85 higher prevalence rates of depression, anxiety and PTSD compared to the rest of the population. In
86 the US, the Panchal *et al*, [7], survey compared all essential workers in any role or setting compared
87 to non-essential workers, finding essential workers to report higher symptoms of depression and
88 anxiety (42% vs. 30%), the onset or increase of substance use (25% vs. 11%), or to have seriously
89 considered suicide in the past 30 days (22% vs. 8%). In a UK poll of healthcare staff (n = 996) 50% of
90 staff reported that their mental health was impacted because of the Covid-19 crisis, [8].

91 METHODS

92 An integrative model of wellbeing was adopted for this study [9], with tracking of symptoms, which
93 refer to the impact of distress on functioning, [10], as well as providing an appreciation of strengths
94 and wellbeing indicators, [11, 12]. Importantly, for healthcare staff in a pandemic, this new tool
95 needed to also incorporate items of work-related impact e.g., burnout, compassion fatigue and
96 vicarious post-traumatic stress disorder [13]. We know that other factors relate to personal resilience
97 too, e.g., meaning to life, [14, 15], sense of threat, [16], self-compassion, [17], sense of connectedness
98 to others, [18], addictions, [19], and moral injury, [20].

99 The core of the wellbeing model as previously used in assessing the relationship between wellbeing
100 and leadership capability, in the development of a protocol for interoceptive self-awareness in email
101 communication, [21], as well as in evaluating the effect of music listening on wellbeing, [22].
102 Developing ones awareness of experiences as they unfold includes: witnessing present moment
103 sensations, bodily states (alert, quiet, pleasant, unpleasant), mental activity (thoughts, feelings,
104 memory, intentions, beliefs, attitudes, etc.) and relational experience (connectedness to others, to
105 nature, etc.), sense of meaning and purpose, and compassionate attitude, [18], ensuring observation
106 nurtures wellbeing as it is conducted in a kind and gentle way, [23]. This has important implications
107 for understanding and evaluation and measurement of human experience.

108 Thus, a diary method was considered appropriate for this study, [21]. It empowered the participants
109 to monitor and reflect on their own experience while being understanding towards oneself (self-
110 kind), thus supporting recovery, [25, 2].

111 The impetus for the development of the diary tool emerged from an NHS region's systems level
112 leadership looking to support the wellbeing of critical NHS and care staff. The diary was co-produced
113 in a process involving NHS staff and university researchers, [26], refined, and trialled for inclusion in
114 the diary. All items were worded with both positive and negative polarity. This enabled both
115 pathology, e.g., severe anxiety, and strengths, e.g., self-compassion, to be tracked. Diary users were
116 encouraged to reflect on their experience and sense of wellbeing, considering the factors identified.

117

118

119 **Participants**

120 The participants were NHS and social care professionals (for example, administrators, care support
121 workers, doctors, nurses, social workers, and student doctors). One hundred individuals participated
122 (Supplementary Table 1). Participants were invited to complete an online diary with 25 questions

123 (Supplementary Table 2) between 14 January and 14 March 2021. In total, 142 diary entries were
124 made, 59 in January, 34 in February, and 49 in March (Supplementary Table 1). Participation was
125 voluntary but it was suggested that users completed the diary once a week.

126 Data analysis methods

127 A non-parametric test, Mann-Whitney-Wilcoxon (Wilcoxon rank sum) was used to run pairwise
128 comparisons for the questions in the diary as there were no prior assumptions regarding the likely
129 average wellbeing scores or the distribution of the data. The pairwise comparisons were made for the
130 diary entries for each month of the trial. In addition, a multiple group comparison was performed to
131 test whether there were any significant wellbeing changes during each of the three months of the trial
132 using a non-parametric test Kruskal-Wallis. The analyses were conducted in R, boxplots were created
133 to illustrate changes in wellbeing using the function *ggboxplot* from the R library *ggplot*.

134 Correlations between each pair of questions were calculated with the Spearman coefficient using the
135 *cor.test* function in R for each month of the trial. In addition, the aggregated correlations for each
136 question pair were calculated across all three months. Heatmaps were produced using the function
137 *heatmap.2* from the R library *gplots* (version 3.1.1).

138 RESULTS

139 Data from one hundred NHS and social care professionals were included in the study. Active
140 participation in the study varied over time with some users completing the diary more regularly than
141 others. This led to an unequal number of records per month during the study period.

142 Quantitative analysis of the diary data

143 In line with research showing that wellbeing and mental health symptoms are separate concepts,
144 [27], the diary questions were split into two corresponding groups. The questions on, wellbeing
145 included, for example, ones on physical, emotion and cognitive/mental wellbeing. Whereas the

146 questions on symptoms, included, for example, ones on burnout, self-harm and anxiety or worry
147 (Supplementary Table 2 shows the full set of questions). These two groups were analysed separately
148 to examine how mental health and wellbeing in general changed over time. Due to the relatively
149 small sample sizes available for the individual weeks, changes from month to month rather than
150 week to week were analysed. The results can be seen in Figure 1A and B.

151

152 [Figure 1 - Change in participant scores for (A) “Wellbeing question group” (B) the “Symptom’s
153 question group”.]

154

155 A statistically significant decline in wellbeing was observed ($P=0.016$ from January to February, $P=2.7E-$
156 07 from February to March, $P<2.2E-16$ from January to March). Similarly, there was a significant
157 increase in symptoms over time ($P=0.041$ for January to February, $P=3E-06$ for February to March,
158 $P=1.2E-14$ for January to March).

159 We found that a significant number of the parameters monitored by the diary showed a decrease in
160 wellbeing and an increase in symptoms (with the spread of data points becoming more negative
161 month by month).

162 Individual analysis of the quantitative questions

163 We investigated each question individually. An initial exploration of the data showed no change for
164 several the questions as users had left the sliders (used to measure scores) at or very close to the mid-
165 point (the default position). In our analysis we only considered the items that exhibited change.

166 Individual wellbeing group question analysis

167 Six of the thirteen wellbeing questions exhibited no change. The questions with a change in scores
168 and those without are shown in Supplementary Table 3A. Figure 2 A-F illustrates the changes for these
169 questions - where A represents the *ability to complete the necessary activities of daily living* ($m=3$), B

170 *how much meaning and value does life have* (m=4), C *quality of sleep* (m=-0.5), D *rating of emotion*
171 (m=2), E *level of alertness* (m=1), F *ability to feel empathy or compassion* (m=5), and where **m**: median
172 score across all participants and months

173

174 [Figure 2 – Wellbeing questions with a change in scores.]

175

176 **Statistically significant declines in wellbeing were observed for the ability to complete the activities of daily**
177 **living, the meaning and value of life, and the quality of sleep (Kruskal-Wallis $P=0.0039$, 0.0059 , and 0.044 ,**
178 **respectively for the three months of the trial). The decline regarding daily living was particularly significant**
179 **from February to March ($P=0.04$) and for January to March ($P=0.00098$).**

180 Supplementary Table 4 shows that many people experienced wellbeing problems. In particular,
181 people reported issues with sleeping (51%), levels of alertness (46%) and negative emotions (44%).

182 Overall, the results show a clear decline in wellbeing over the trial, with significant proportions of
183 people reporting problems.

184 Individual symptom group question analysis

185 Six out of the twelve symptom group questions exhibited no change. The questions with a change in
186 scores and those without are shown in Supplementary Table 3B. Figure 3 A-F illustrates the changes
187 for these questions - where A represents *flashbacks* (m=5), B *dissociation* (m=4), C *bodily symptoms*
188 (m=5), D *self-harm* (m=10), E *risk of harm from others* (m=10), F *dependence on drugs or alcohol* (m=9),
189 and where **m** is the median score across all participants and all time points.

190

191 [Figure 3 – Symptom group questions with a change in scores]

192 The results suggest that indicators of post-traumatic stress disorder (PTSD), including, flashbacks,
193 dissociation, and bodily symptoms (Kruskal-Wallis $P=0.00081$, 0.0083 , and 0.027 , respectively)
194 became significantly worse during the trial. Supplementary Table 5 shows that substantial numbers of

195 people reported problems, particularly flashbacks (22%), feelings of dissociation (32%) and bodily
196 symptoms (23%). In addition, the percentage of people reporting burnout was 41%, anxiety 46%, and
197 struggling to feel pleasure or motivation (a sign of depression), 37%.

198 In summary, we observed a statistically significant increase in symptoms, including significant
199 numbers reporting burnout, anxiety, and signs of depression.

200 **The questions with the highest and lowest levels of mental health and general wellbeing**

201 Supplementary Tables 6 and 7 show the ten questions where participants had the highest and
202 lowest levels (respectively) of mental health and general wellbeing during the trial. Relatively few
203 people reported risk of harm from others, self-harm and drug and alcohol dependency. Whereas the
204 poorest levels of wellbeing were for quality of sleep, anxiety/worry and overall emotional state.

205 The data also suggested improvements in dependency on drugs or alcohol, in empathy /
206 compassion, alertness and physical state, but deteriorations in experience of flashbacks, how fearful
207 people are, and overall emotion scores.

208 **Impact of different activities on wellbeing and symptoms**

209 The impact of different activities, such as exercise (see Supplementary Table 8 for a full list of
210 activities) on wellbeing and symptoms was investigated. The changes in scores were plotted per
211 month (see Figures 4 A and B).

212

213

214 [Figure 4 - Change in participant scores undertaking activities for (A) *Wellbeing group questions*, (B)
215 *Symptoms group questions*.]

216

217 A multi-group comparison (Kruskal-Wallis $P > 0.05$) showed that overall, the activities did not have a
218 statistically significant impact. *Exercise/physical activity* ($P = 0.03$) and *other* (non-listed) activities
219 ($P = 0.0084$) in February were the only ones to show significant changes (improvements). However,
220 there was obvious trend towards improvement for some of the other activities. For instance, spending
221 *time with animals* ($P = 0.12, 0.15, 0.15$ for January, February, March, respectively), *exercise/physical*
222 *activity* ($P = 0.26, 0.03, 0.29$ for January, February, March, respectively), and interest in *music* ($P = 0.18,$
223 $0.05, 0.58$ for January, February, March, respectively) - especially for those spending *time with*
224 *animals*. Users who *dance* had statistically significantly higher scores for only February.

225 The effect of the activities on the *wellbeing* and the *symptoms questions* overall were generally similar.
226 However, where users engaged in *peer support*, they had statistically significantly higher scores for
227 *wellbeing* ($P = 0.03, 0.04, 0.12$ for January, February, and March).

228 These results suggest that certain activities during lockdown had the potential to enhance participant
229 wellbeing. They include spending time with animals, musical activity, engaging in peer support, and
230 physical activity.

231 DISCUSSION

232 This method of monitoring wellbeing was developed in response to the need to support health and
233 care staff during the Covid-19 pandemic. The data showed that wellbeing did deteriorate over the
234 winter months of 2021 when the pandemic was in another wave and lockdown was experienced
235 across the UK. This is in line with other research, [28, 29, 30]. Factors that were particularly impacted
236 were numerous. People described feeling less able to conduct tasks of daily living. Such functioning
237 is an important aspect of wellbeing in recovery focused models of mental health. Sleep was poor
238 amongst participants and this deteriorated. Poor sleep is problematic because it leaves people
239 physically tired and emotionally volatile, [31]. One participant described it as their “canary in the
240 mine”, meaning they see it as an early warning sign for their own mental health. Meaning to life also
241 deteriorated significantly, suggesting that the barren social landscape of persistent lockdown had

242 impacted on peoples' sense of value. Interestingly, there is no evidence that suicide has actually
243 increased in this group, [32], but some ideation that life did not have much meaning or value was
244 relatively common.

245 Professional quality of life is determined by factors such as burnout, vicarious PTSD, and compassion
246 fatigue, [33]. Whilst the wellbeing diary is not diagnostic, a significant number of staff felt tired and
247 numbed from their work. This factor associated with burnout was reported by 41% of people.

248 However, it did not appear to deteriorate. Signs of post-traumatic stress were also very prevalent
249 with this increasing over the three-month period from 10 to 39%. Staff reported an increase in
250 flashbacks showing that such re-experiencing of troubling traumatic events were common, and
251 increases in self-harm, dissociation and experiencing unusual things / having concerning ideas.

252 Compassion fatigue was less prevalent and did not worsen, which shows the values-based resilience
253 of staff in the face of their work-related symptoms. The notable presence of work-related
254 psychological distress is in line with other research, [30], and requires staff support services to
255 address these work-related harms by arranging healing opportunities. PTSD, in particular, can
256 benefit from trauma specific psychological therapies aimed at processing the traumatic events
257 driving the symptoms. Some staff may need to be facilitated to change posts or careers if they feel
258 unable to put themselves in harm's way repeatedly.

259 It is interesting that few of the activities that may have been thought likely to have a positive impact
260 on mental health, actually did. Exercise was the activity most associated with positive mental health,
261 although music and animals also helped. It is important to bear in mind that such 'interventions'
262 need to form part of the healthy wellbeing culture of our lives even though they can't be manualised
263 or subject to randomised control trials very easily and items such as dancing would not be as
264 effective on their own in the house rather than with others. Of note is that the main factor to
265 moderate wellbeing was access to support from peers. Peer support models have been importantly
266 rolled out across many services but sometimes such support forms part of the implicit informal

267 relational texture of teams and this is not to be underestimated. Team functioning, time for informal
268 connection and the maintenance of established working alliances is critical to wellbeing [20].

269 The wellbeing diary was intended as a tool to empower individuals to enhance their awareness of
270 wellbeing. The participants were people working in health, and diary use was voluntary.

271 Participation diminished over time and we speculate that this may have been due in part to staff
272 working under significant pressure during the pandemic and as a result were not easily able to
273 devote time to using the diary. This resulted in a limitation to the study as the number of diary
274 entries per month were unequal. Another factor may have been that the diary was not integrated
275 into the working processes of the organisations.

276 In a systematic review focused on the implementation and effects of psychological wellbeing
277 interventions in the workplace, Daniels et al found that learning support structures like mentoring
278 and coaching, and inclusive governance structures were critical to the success of workplace health
279 and wellbeing practices [3].

280 As a result of the diary, staff wellbeing support services were able to respond with interventions
281 based on needs that emerged, e.g., an insomnia group. The diary shows promise as an alternative
282 way of empowering staff to reflect on their wellbeing and is an potentially valuable resource to show
283 trends in different groups and over time at a population level.

284

285 CONCLUSIONS

286 The wellbeing diary highlighted the level of distress among participating health and care staff and
287 the need for timely intervention to support their wellbeing. It showed the range, depth, and
288 idiosyncrasy of the interplay between wellbeing factors. Some of the group chose actively and of
289 their own volition to self-monitor themselves. This opportunity to channel motivation for self-
290 awareness over time has not been part of occupational health culture. It represents a shift towards

291 empowerment and a move away from a diagnostic view of mental health. It was very apparent that
292 wellbeing was adaptive and multi-layered. It will be interesting to explore with users of the diary
293 which factors are most relevant to them at various times. It will also be interesting to explore the
294 ongoing impact of the various mitigations. The data showed that factors which did not have a
295 recommendation by NICE (National Institute for Health and Care Excellence) seemed to make the
296 biggest difference, for example, exercise and peer support. Perhaps within a more clinically unwell
297 population of staff this may not hold up so well but generally, these were proving important
298 preventative factors.

299 The level of engagement with the diary varied by individual over time. This unequal number of diary
300 entries per individual was a limitation on the analysis. However, the diary can help distinguish trends
301 in wellbeing over time and the numbers of staff reporting difficulties in particular wellbeing
302 domains, enabling staff wellbeing services to respond and address these, e.g., putting in place
303 support for addictions (for example, drug and alcohol). It can help ensure that accurate interventions
304 are targeted to at risk staff. This will require services to continue to be agile, innovative about their
305 offers and flexible about meeting staff need with differing individual profiles.

306 The results particularly emphasised the pressing need for interventions that help staff with burnout,
307 self-compassion, and flashbacks. It also demonstrates the value of population-based wellbeing data
308 that is driven by a trauma informed model of mental health in informing how services can determine
309 and respond to need. Finally, the large proportion of staff with varying areas of distress was obvious.
310 Outreach and engagement will be a key part of any service set up to serve the health and care
311 workforce.

312

313 LIST OF ABBREVIATIONS

314 PTSD (Post Traumatic Stress Disorder)

315 NICE (National Institute for Health and Care Excellence)

316 NHS (National Health Service)

317 DECLARATIONS

318 **Ethics approval and consent to participate**

319 We confirm that Ethics Committee of the Faculty of Engineering and Environment Northumbria

320 University, Newcastle upon Tyne, provided approval for the study. Approval reference #23709.

321 Informed consent was obtained from all subjects and/or their legal guardian(s) for the study.

322 Participants were shown the participant information details and were asked to agree to take part

323 before any data was collected. All methods were conducted in accordance with relevant guidelines

324 and regulations.

325 **Consent for publication**

326 Not applicable

327 **Availability of data and materials**

328 The datasets used and/or analysed during the current study are available from the corresponding

329 author on reasonable request.

330 **Competing interests**

331 The authors declare that there is no competing / conflicts of interest.

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335 **Authors' contributions**

336 PS and AK conceived the study, with AK responsible for recruiting participants, PS responsible for the

337 design of the experimental components, qualitative analysis together with AK and ZK. ZK responsible

338 for the design of the statistical analysis. AK and PS led the preparation of the online diary questions.

339 GE and LW designed all of the online screening tools for collecting the different types of data. PP

340 helped to revise the results from the statistical data analysis and with the preparation of
341 illustrations. All authors drafted the manuscript, and read, revised, and approved the final
342 manuscript.

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