

1 **The impact of the live broadcast of Stromae's song *L'enfer* on social media**
2 **publications, calls to the national helpline, and suicide attempt rates in France**

3 Shortened title: Impact of the broadcast of Stromae's song *L'enfer*

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26

Abstract

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On January 9, 2022, Belgian pop singer Stromae performed his new hit "L'enfer" live

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on French TV. The song addresses his personal struggles with suicidal ideation. To

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evaluate the impact of Stromae's performance, we modelled the evolution of hospital

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admission rates for suicide attempts in France, calls to the national suicide

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prevention helpline (3114), and Twitter publications mentioning the singer or the

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helpline. We employed the Gombay test to identify change points within each time

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series. We identified a significant increase of mean suicide attempt rates in women

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aged 20 to 24 years old six days after the singer's performance. No similar effect was

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observed in the general population or other young age groups. The show was

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immediately followed by a peak in tweets referring to the singer, while Twitter activity

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related to the 3114 remained modest. We did not observe any increase in calls to the

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helpline. Celebrity testimonies about suicidal experiences can help alleviate stigma

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but should be accompanied by prevention messages to reduce the risk of contagion.

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Keywords

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suicide attempt; suicide contagion; social media; helpline

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Manuscript

45 On January 9, 2022, the famous Belgian pop singer Stromae performed his
46 new hit "L'enfer" ("Hell") live on a major French evening news program, reaching over
47 7.3 million viewers. In "L'enfer," Stromae explicitly discusses his experience with
48 suicidal ideation and negative feelings, resonating with others who have faced similar
49 struggles. The performance was perceived as a breakthrough moment in suicide
50 prevention, promoting more open discussions about suicidal behaviors. The event
51 also garnered significant online attention, with numerous social media posts
52 referencing suicide prevention. However, the impact of this type of event on suicidal
53 outcomes, help-seeking behaviors and social media reaction remains unclear.

54

55 To evaluate the effect of Stromae's performance, we utilized records from the
56 French exhaustive discharge database, the Programme de Médecine des Systèmes
57 d'Information (PMSI), to identify hospitalizations related to suicide attempts (SA). We
58 included patients aged 10 years and older, discharged between January 1, 2021, and
59 March 31, 2023, with International Classification of Diseases codes X60 to X84.
60 Additionally, using the Tweepy API, we extracted all tweets containing the keywords
61 "Stromae" and/or "3114" posted between January 1, 2021, and May 31, 2022. Finally,
62 the IT department of 3114, the new French national helpline, provided weekly
63 exhaustive exports of time-stamped incoming calls from its launch on October 1,
64 2021, to March 31, 2023. We analyzed the evolution of SA-related hospital admission
65 rates, number of tweets, and calls to 3114 as time series, which we modeled using
66 Auto-Regressive Integrative Moving Average (ARIMA) processes. To assess whether
67 Stromae's performance was associated with significant changes in temporal patterns,
68 we applied a Gombay change-point test to each ARIMA model. When a significant

69 mean change-point was identified, we split the time series, computed separate
70 ARIMA models before and after this point, and compared the corresponding
71 parameters. For SA time series, we first analyzed the overall population, then
72 performed subgroup analyses on adolescents and young adults (women aged 15-19,
73 men aged 15-19, women aged 20-24, and men aged 20-24), who are known to be at
74 higher risk for SA, especially since the COVID pandemic [1]. The study protocol was
75 approved by the Montpellier Institutional Research Board (IRB-202201299).

76

77 Between January 1, 2021, and March 31, 2023, 197,224 individuals were
78 admitted to hospitals for SA, with a mean daily admission rate of 241 ± 33.8 . Most
79 patients were women ($n = 152,639$, 79.2%). Of the attempters, 23.0% ($n = 35,076$)
80 were aged 15 to 19 (80.5% were women), and 13.1% ($n = 19,993$) were aged 20 to
81 24 (66.3% were women). Time series results are presented in **Figure 1**. The
82 Gombay tests did not detect any significant change point in the SA time series of the
83 general population, individuals aged 15 to 19 or men aged 20 to 24 around the time
84 of Stromae's performance. However, a significant change point was detected in the
85 mean component of the ARIMA process for women aged 20 to 24. In this group, SA
86 time series exhibited a breakpoint on January 15, 2022, six days after Stromae's
87 performance (p -value < 0.001). The estimated means shifted significantly from 14.9
88 ($SE = 0.3$) before the change point to 17.3 ($SE = 0.2$) after the change point,
89 indicating an increase of 2.4 hospitalizations for SA per day. We did not detect any
90 significant change-point around Stromae's performance in the 3114 helpline activity.
91 A peak in tweets referencing Stromae occurred immediately after the performance,
92 with 5,551 and 8,301 posts on January 9 and 10, 2022, respectively. Two other peaks
93 were observed: 4,902 posts on October 15, 2021, corresponding to the album

94 announcement, and 3,750 posts on March 4, 2022, coinciding with the album
95 release. The maximum number of posts tagging the 3114 was 116 at the helpline's
96 launch, but there was no peak after Stromae's performance. Only 44 tweets
97 mentioned both the 3114 and Stromae the day after the performance.

PLEASE INSERT FIGURE 1 HERE

98

99 Although limited, some literature indicates that artistic performances can have
100 either a precipitating or protective effect on suicidal behaviors. For instance, Stack
101 and al. found anecdotal evidence that the release of the song "gloomy Sunday"
102 written by the Hungarian composer Rezső Seress triggered cases of suicides [2].
103 Conversely, the broadcast of '1-800-273-8255', a hip-hop song referring to the
104 American National Suicide Prevention Lifeline, was associated with an increased
105 number of calls to the line as well as stronger engagements to its twitter account [3].
106 The absence of concomitant increase of SA rate suggested a protective effect.

107 Whether a media content referring to suicide provokes contagion or help-
108 seeking behaviors but also the magnitude of these effects, depend on both
109 quantitative and qualitative characteristics that are becoming better understood.
110 Firstly, the probability of any behavioral impact increases with the audience size of
111 the media content [4]. Stromae's performance took place on the most widely watched
112 French TV show, with over 10% of the population tuning in live. The subsequent
113 surge in social media engagement, particularly evident in increased Twitter activity,
114 suggests a strong public interest and likely reflects the show's wide exposure. This
115 extensive broadcast heightened the chances that the song and its message reached
116 susceptible viewers. Second, the impact of exposure to media content related to
117 suicide mostly depends on its qualitative attributes. The risk of contagion appears to

118 be particularly important for celebrity suicides [5], and sensational, dramatic or
119 inaccurate productions [6]. Conversely, protective effects have been associated with
120 media contents that convey hope and provide resources [6,7]. Stromaë is a globally
121 recognized celebrity who publicly shared his mental health struggles. “L’enfer” delves
122 into feelings of guilt and shame and reveals his suicidal ideation in straightforward
123 poetic style that emphasizes distress. While it convokes a shared experience, it
124 contains no message of hope for improvement, potentially conveying a sense of
125 inevitability. During his live TV performance, the channel didn’t mention any helpline
126 services like the 3114. This lack of support translated to minimal interaction on social
127 media related to the helpline. The combination of increasing SA rates among young
128 women and absence of an increase in calls to the helpline may be related to a
129 contagion effect that went unmitigated by a protective response. Thirdly, some
130 segments of the audience have been identified as increased risk of contagion.
131 According to the differential identification theory, this risk is higher in individuals who
132 admire (vertical identification) and recognize some element of themselves (horizontal
133 identification) in the deceased celebrity [8]. Consistent with this theory,
134 epidemiological research has consistently shown that the probability of contagion is
135 higher in individuals of the same age and sex as the celebrity. Our results diverge
136 with this pattern, as we found that only women younger than Stromaë were affected
137 by an increase of SA rates. However, youth is recognized to be at higher risk of
138 suicidal contagion [9]. Under the hypothesis of the Werther effect, it is possible that
139 young women did not identify with the singer based on age or gender but connected
140 more deeply with the emotions he expressed. Stromaë’s performance coincided with
141 the aftermath of COVID-19 pandemic, a period marked by a notable surge in suicidal
142 ideation and SA in young women. Evidence exist that the risk of imitative behaviors

143 would be higher in distressed individuals [10]. Therefore, "L'enfer" could have
144 resonated most strongly within the demographic most affected by the public health
145 crisis.

146 Our study is subject to several limitation: (a) The national PMSI database may
147 underestimate the frequency of SA because it only records emergency stays lasting
148 more than 24 hours. (b) At the time of Stromae's performance, the 3114 had only
149 been in operation for four months. The calls pattern we observed reflects a ramp-up
150 that might have overshadowed a breaking point. (c) Due to technical constraints, we
151 were unable to access the demographics of the individuals who called the 3114.
152 Therefore, we cannot exclude the possibility of a specific increase in calls from sub-
153 groups such as young women.(d) We were unable to extract the tweet history beyond
154 May 31, 2022 due to social media sites' restrictions.

155 Because suicidal behaviors are highly multidetermined, causal assumption
156 represent a strong and widely discussed challenge when determining the impact of
157 media productions. While our findings do not allow us to definitively conclude that
158 Stromae's intervention was associated with a WE, our methodology offers solid
159 support for this hypothesis. Interrupted time series are increasingly considered the
160 gold standard for assessing causality in such contexts (see, for instance,). By
161 accounting for underlying trends and self-generated changes, they enable the
162 detection of distinct breaks that are likely attributable to specific events. Although we
163 cannot entirely exclude the influence of other concurrent events, the significant media
164 impact of Stromae's intervention suggests it likely played a role in the break we
165 observed in SA rates in young women. assumption by identifying the change point in
166 a bottom-up manner. Additionally, , the Gombay test, which identifies change points

167 using a bottom-up approach, strengthens the causal argument by mitigating biases
168 that arise from aligning time series interruptions directly with the intervention.

169 The present study provides a unique case-study of the impact of widely
170 publicized testimonies of suicidal experiences, particularly those involving celebrities.

171 While such events can help reduce the stigma surrounding suicidal ideation and

172 behaviors, they may also paradoxically have a contagious effect. Instead of

173 censoring artistic expressions, it is crucial to foster collaboration to ensure these

174 testimonies are accompanied by prevention messages and resource provision.

175

176 **Conflicts of Interest:** The authors declare none.

177 **Competing interests:** Author C-E Notredame is the deputy coordinator of the 3114
178 helpline, which is a non-profit service financed by the French government. The other
179 authors declare no competing interests.

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182 **Data availability:** Data can be obtained by contacting the corresponding author

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Figure legends

220 A. Time series of admissions for suicide attempt among women aged 20 to 24. The
221 orange line represents the best fitting ARIMA predictions before and after Stromaë's
222 intervention (purple dashed line). B. Time series of calls to the 3114 helpline. The
223 orange line represents the best fitting ARIMA predictions. C. Time series of count of
224 tweets containing a reference to Stromaë. Arrow 1 corresponds to the announcement
225 of the album release, arrow 2 corresponds to this release.

