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Article

An interactive video increasing French students' mental health literacy: a mixed-methods randomized controlled pilot study

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Summary

Mental health literacy (MHL) is a determinant of psychological well-being in young people. A randomized controlled design was used to evaluate the appreciation and effectiveness of an interactive video on French University students' MHL (knowledge about depression and suicidal behavior, mental health help-seeking behaviors, stigma and misconceptions about mental health). At the baseline, all participants ($n = 101$) completed a questionnaire including several scales on MHL. One month after, participants were randomly assigned to two homogeneous groups (intervention, $n = 50$ or control, $n = 51$) and again completed the questionnaire on MHL. Through a mixed-methods approach, semi-structured interviews were also conducted with the intervention group to collect information on the appreciation of the interactive video. Quantitative data indicated that MHL scores increased or remained stable in the intervention group. Comparison with the control group and multivariate logistic regression models did not show statistically significant differences, due to the small sample of the study. According to qualitative data, users appreciated the content and the format of the intervention. It was suggested that the video could be disseminated in other University campuses in France and internationally to promote MHL among students.

Key words: mental health literacy, digital intervention, university students, evaluation, mixed-methods

INTRODUCTION

Mental health literacy (MHL) is a multi-construct theory defined as the access, understanding, appraisal and use of mental health information that aids recognition, prevention and treatment of mental disorders (Jorm, 2000; Kutcher *et al.*, 2016). Previous research has shown that MHL is a key determinant of access to resources for individual health and wellbeing at all stages of life (Furnham and Swami, 2018).

Interventions aimed to increase MHL are particularly focused on student populations (Kutcher *et al.*, 2016). Indeed, the onset of mental health problems is before 25 years (Kessler *et al.*, 2005), the corresponding age whereby 56% of young adults are in tertiary education

in the Organization for Economic Cooperation and Development (OECD) area (OECD Indicators, 2010). A comprehensive review of 24 studies measuring the prevalence of depression in University students indicated an average lifetime prevalence of 30.6% (Ibrahim *et al.*, 2013). A meta-analysis of 36 University student samples has found that about one out of four students have experienced some form of suicidal ideation (Mortier *et al.*, 2018). These numbers underline the fact that University campuses are important venues to help students navigate mental health information and increase their knowledge on mental health problems (Clough *et al.*, 2019).

Previous studies have proved the efficacy of interventions targeting MHL among University students (Lo *et al.*, 2018). These interventions were delivered face to face, online, or a combination, using different learning approaches including didactic sessions, interpersonal relation, cognitive-behavioral learning and gamification. In particular, two systematics reviews have established the effectiveness of web-based MHL interventions (Brijnath *et al.*, 2016; Tay *et al.*, 2018) demonstrating that online programs and tools can address a large number of students without time and space constraints, preserve privacy and produce positive outcomes corresponding to enhanced knowledge, improve behavioral styles and decrease depressive symptoms (Lattie *et al.*, 2019). Interventions comprising an active component, such as videos or quizzes, have proven to be the most effective (Tay *et al.*, 2018) since they provide an opportunity to practice behavior in a relatively engaging environment and learn by doing (Fitz-Walter *et al.*, 2011; Tuijnman *et al.*, 2019).

As synthetized by above-mentioned reviews (Brijnath *et al.*, 2016a; Lo *et al.*, 2018; Tay *et al.*, 2018), MHL interventions have been mostly conducted in Australia, Canada and the USA. There is a paucity of intervention studies conducted on this topic in Europe. Furthermore, while some of the existing interventions utilized gold-standard study designs, such as randomized controlled trials (Reavley *et al.*, 2014) or longitudinal post-tests (Li *et al.*, 2013), the majority did not use validated scales (e.g., the all-encompassing Mental Health Literacy Scale [MHLS]; O'Connor and Casey, 2015). Furthermore, a mixed-methods approach combining quantitative scores from validated scales and qualitative data from semi-structured interviews has not been applied (Brijnath *et al.*, 2016a; Tay *et al.*, 2018).

The current randomized controlled pilot study attempted to evaluate the appreciation and the effect of a co-constructed interactive video on MHL of students from a French University through the collection of both quantitative and qualitative data. The main questions of this pilot study are: (i) can an interactive video on depression and suicidal behavior increase University students' knowledge about mental health problems; (ii) can this interactive video enhance University students' mental health help-seeking behaviors; and (iii) can this interactive video decrease University students' stigma and misconceptions about mental health? We hypothesized that our intervention would enhance these three specific domains of MHL and be appreciated by students, ultimately providing evidence on the effectiveness and appropriateness of this digital tool.

METHODS

Participants and procedure

A total of 101 students participated in our pilot study. They were all recruited from a sample of 483 students who had answered a tablet-based questionnaire administered by a peer surveyor in one of the five campuses of the University of Bordeaux between October and November 2018. For this phase of recruitment (baseline phase), students were selected according to pre-defined fixed quota so that sex (60% of female students) and fields of study (40% Health Studies, 30% Law and Economics, 20% Technical Sciences, 10% Human and Social Sciences) were representative of the Bordeaux student population (2017 enrollment report). Students had to be between 18 and 30 years old to be eligible to complete the study. Between November and December of 2018, participants were invited to participate in the second phase of the study (intervention phase) through e-mail, SMS and telephone calls. Of the 438 students from the baseline phase, 101 (20.9% retention rate) agreed to participate in the intervention phase. Participants were assigned to either the intervention ($n = 50$) or the non-intervention control ($n = 51$) using a random numbers table. The intervention consisted of an interactive video that students watched in a dedicated room of our research center. An investigator was present during the video-viewing session in order to record the different choices of the student. Once the video was finished, the investigator asked the student to respond to a semi-structured interview concerning the video and its' impact on MHL dimensions. Participants of the non-intervention control group were offered and informed of several resources, including brochures on depression and suicide risk with the list of University mental health facilities and support programs conducted by our research center. At the end of both the intervention and the

control group session, all 101 students were asked to complete the same baseline questionnaire on a tablet.

Intervention: the interactive video 'What would you have done in my place?'

In order to propose an intervention tailored on students' needs, the co-creation approach was utilized (Galvagno and Dalli, 2014), whereby students assisted in creating the intervention. The co-creation process we conducted belongs to the broader paradigm of Participatory Health Research (Wright, 2015). Our intervention was also based on the principles of interactive health communication, which uses digital technology to deliver health messages (Fotheringham *et al.*, 2000), electronic learning, [e.g., the pedagogical approach based on digital tools for a more personalized transmission of knowledge; (Hanley, 2004)], and gamification (Cugelman, 2013).

Our interactive video is called 'What would you have done in my place?' and addresses the theme of psychological distress among University students. The scenario was written by one medical student and one graduate research assistant, discussed and reviewed by a pool of students from different disciplines, and validated by a public health research team, communication experts, and mental health professionals. The video lasts a total of 30 min and is split in several sequences of 3 min maximum. The protagonists of the video are two young students: Laura is an 18 years old medical student; and Lucas is a 20 years old student of computer science. The viewer has to choose to follow the story either from Laura's or Lucas's perspective. In both story lines, the intervention offers explicit choice points concerning recognition of signs of mental health problems, help-seeking or help-giving and reflection on stigma. Each user has to make choices including options that could lead Lucas towards or away from committing suicide. Throughout the video, tips are given to: recognize depression symptoms according to the nine criteria of the Patient Health Questionnaire (PHQ-9) (Kroenke *et al.*, 2001); identify suicide warning signs following the Diagnostic and statistical manual of mental disorders (DSM-5®; American Psychiatric Association, 2013); know available services and professionals for help-seeking; and dismantle stereotypes by showing that mental health problems affect everybody. The video is on YouTube (https://www.youtube.com/watch?v=PCm9U642kzQ). Supplementary Figure S1 shows illustrative fragments of the video.

Measures: quantitative and qualitative tools

The tablet-based questionnaire comprised 88 items: 13 items on socio-demographic characteristics, mental health conditions, and sources of information, plus 75 items issued from the translated and revised versions of five MHL validated scales.

Socio-demographic characteristics included: sex, age (median and quartiles), being an international student, field of study, year of study, main source of income and monthly all-inclusive resources. Mental health conditions included: self-rated mental health, the Kessler Psychological Distress Scale (K6; Kessler *et al.*, 2002) (0–4 points for each item, total score from 0—low distress—to 24—high stress), lifetime diagnosis of a mental health problem, intake of any medication for anxiety, anguish or stress in the last 12 months, and talking to a health professional.

MHL validated scales were the General Help-Seeking Questionnaire (GHSQ; Rickwood *et al.*, 2005), the MHLS (O'Connor and Casey, 2015), The Mental Health & High School Curriculum Guide for students (The Guide STUDENT PRE; Kutcher and Wei, 2013; Kutcher *et al.*, 2016) and the Mental Health-Promoting Knowledge (MHPK-10) measure (Bjørnsen *et al.*, 2017). For all scales, medians and quartiles were calculated.

The GHSQ asks test-takers if they would seek help among nine professional and lay sources. Possible responses include yes (1), maybe (0.5) or no (0) with scores ranging from 0 to 9, with higher scores indicating greater attitudes to seek help. The Cronbach alpha for internal consistency in our sample was 0.56. For the purpose of this study, we also presented results per item in order to have a fine-grained idea of the types of resources addressed by the students: mother, father (or legal tutor); brother, sister, half-brother, half-sister; other family member; close friend; teacher, advisor (or other adult working at my university); Priest, Rabbi, Imam (or other spiritual or religious leader); general Practitioner; mental health professional (e.g. psychologist, psychiatrist); and (mental) health professional working in my university (e.g. at the Student Health Service).

The MHLS covers the following MHL dimensions: recognition of mental disorders (8 items), ability to seek information (4 items), knowledge of risks and causes of mental health problems (2 items), attitudes that promote health (2 items), knowledge of professional help available (3 items) and beliefs and attitudes that promote appropriate help-seeking (16 items), for a total of 35 items. Responses are summed to produce a total score ranging from 35 to 160, with higher scores indicating greater MHL. In the current study, the Cronbach's alpha for internal consistency was 0.77. The item on depression (If someone experienced a low mood for two or more weeks, had a loss of pleasure or interest in their normal activities, if their appetite and sleep change, would you say that they suffer from severe depression? Very unlikely, unlikely, likely, very likely) was also analyzed separately.

We used 13 items from The Guide STUDENT PRE which are presented in a 'True or False' and 'Do not know' format. A correct answer is awarded 1 point and total score ranges from 0 to 13. The 'Do not know' answer corresponds to 0 points. In the current study, the Cronbach's alpha for internal consistency was 0.53.

The MHPK-10 was adapted to the student population by modifying and adding some items for a total of 13 items instead of the original 10. Respondents were asked to rate each item on a 4-point scale: 'Not important at all' (1), 'Of minor importance' (2), 'Important' (3) and 'Very important' (4). Higher scores (minimum 13 and maximum 52) correspond to greater positive psychology attitudes. In the current study, the Cronbach's alpha for internal consistency was 0.73.

The same baseline questionnaire, excluding constant socio-demographic information, was completed again after the intervention or control.

Students from the intervention group completed a semi-structured interview. The guide was composed of two main themes (impressions about the video and perceived increase of MHL) and sub-themes (appreciation of the format, comments on the story-board, advice for future deployment, knowledge of mental health problems, recognition of depression and suicide risk symptoms and help-seeking behavior). Themes were constructed based on the items of the scales administered to participants (e.g. help-seeking, stigmatization and knowledge of mental health problems). The questionnaire and the semi-structured interview guide are available as Supplementary materials (Annexes S1 and S2).

Quantitative analysis

Socio-demographic characteristics, mental health conditions and MHL data were described using counts and percentages for qualitative variables and median and quartiles for quantitative variables. A comparison of sociodemographic characteristics and mental health conditions between the intervention group and the control group was carried out using tests of comparison of means (normal law) and Chi-squared tests of independence or Fisher's exact tests. For each group, we also compared MHL median scores between the phase 1 (baseline) and the phase 2 (after intervention) through Wilcoxon Median Comparison Tests. We also compared the results of all items of the GHSQ scale and the single item of MHLS on depression.

We constructed a table summarizing the evolution of MHL scores between the two phases according to the baseline level (phase 1) for each group. For this purpose, we divided the scores at phase 1 based on the median and the scores at phase 2 based on the quartiles. Thus, we distributed participants according to their score evolution across the quartiles: small increase (moving 1 quartile, e.g. from 1st quartile to 2nd quartile), large increase (moving 2 or 3 quartiles, e.g. from 1st quartile to 3rd quartile), small decrease (moving 1 quartile, e.g. from 4th quartile to 3rd quartile), strong decrease (moving 2 or 3 quartiles, e.g. from 4th quartile to 1st quartile), stable but low score (remaining in the 1st or 2nd quartile) and stable but high score (remaining in the 3rd or 4th quartile).

Multivariate logistic regression models were performed to study the association between the scores obtained on the four MHL scales and the score of the associated MHL scale at phase 1. Median values were utilized in the MHL scales and were adjusted on mental health status variables in phase 2, sex and the socio-demographic variables, which were significantly different between the two groups. Sex was included as a covariate as literature indicates mental health conditions and knowledge differ significantly between sexes (Rosenfield *et al.*, 2018). Odd ratios (ORs) and the 95% confidence intervals (CIs) were reported. The interactions between each variable in the models were tested. Interactions with a p-value < 0.25 were kept in the initial models before obtaining the final models. Statistical significance was defined with a p-value < 0.05. Because of an informatics error on the tablet, only responses to the MHLS scale were available for all 101 participants. Full data were available for 29 (out of 51) participants in the control group and 41 (out of 50) participants in the intervention group, for a total of 70 complete cases. Given the small sample, imputation of missing data was not conducted due to potentially low statistical power in our analyses. However, within each group, we compared all subjects with and without missing data at phase 2 based on socio-demographic characteristics and mental health conditions. From this analysis, it was possible to assess whether the loss to follow-up were different from individuals who were still included in the study at phase 2. Comparisons were performed using Wilcoxon Median Comparison Tests and Chi-squared tests of independence or Fisher's exact tests. The data were analyzed with SAS® (V.9.3; SAS Institute Inc, Cary, North Carolina, USA).

Qualitative analysis

Semi-structured interviews were audio-recorded, fully transcribed and de-identified. Two investigators independently read and summarized the transcripts applying inductive and deductive methods and finally classified

the transcripts in a table according to the themes and sub-themes proposed in the interview guide (see Supplementary Annex S2). The investigators also selected example quotations for each sub-theme according to subjective relevance and included them in the table. Then, each investigator analyzed the classified texts following a Grounded Theory approach (Strauss and Corbin, 1994). Results of the analyses were discussed with a third investigator to establish a final report.

Mixed-methods analysis

We combined quantitative data (responses to closed-ended questions and scales) with qualitative ones (narrations from semi-structured interviews; Cresswell *et al.*, 2003). Following the classification by Greene (Bliss, 2008), the specific purposes of our mixed-method design were triangulation (seeking convergence, corroboration and correspondence of results from different methods) and complementarity (seeking elaboration, enhancement, illustration and clarification of the results from one method with the results from the other method).

RESULTS

Socio-demographic characteristics and mental health conditions of the study population

We observed that the intervention and control groups were homogenous, except for the year of study. The majority of respondents from the control group were in the 1st or 2nd year, while students in the intervention group were mostly in the 3rd year or more (p-value = 0.040). For this, we entered the year of study in the regression models as an adjustment variable. Supplementary Table S1 in the Annexes presents the socio-demographic characteristics and mental health conditions of the groups at the baseline.

Results of the comparisons within each group (Supplementary Tables S2 and S3 in the Annexes) showed that there were no statistically significant differences between lost to follow-up and retained participants.

Effects of the intervention

We calculated the median and quartiles of each MHL scale after the intervention and observed their evolution from phase 1 to phase 2. Results for each group are shown in Table 1. GHSQ and MHLS median scores increased in the intervention group (+1.5 and +4 points, respectively) with p values close to significance. However, the Guide STUDENT PRE and the MHPK-10 median scores remained stable. In the control group, the MHLS score significantly increased from phase 1 to phase 2 ($p = 0.014$).

Table 2 shows the evolution of the scores from phase 1 to phase 2 within each group. We considered the evolution by quartiles starting from the median scores at the baseline.

Concerning the GHSQ score, the percentage of subjects who maintained a high score was higher in the intervention group (70.6%) than in the control group (38.5%), while the percentage of subjects who increased their score was higher in the control group (38.5% vs. 5.9%). Scores in the intervention group were already high before watching the video. On the other hand, in the intervention group, the majority of participants increased their score (58.3%) while half of the control group remained with a low score (50%), confirming that the low scores evolved in the intervention group. When looking at single items of the GHSQ, seeking help from different sources significantly increased from phase 1 to phase 2 ($p < 0.001$ for all items). In particular, students addressed general practitioners (35.7% vs. 45.7%), mental health professionals (e.g., psychologists and psychiatrists; 35.7% vs. 51.4%) and mental health professionals working in the University (e.g., Student Health Service; 14.3% vs. 31.4%) at a larger extent during phase 2.

Concerning the score of The Guide STUDENT PRE, individuals in the control group who maintained a high score were more numerous than individuals in the intervention group (76.9% vs. 61.5%). Furthermore, those in the control group who decreased their score were less numerous than those in the intervention group (23.1% vs. 38.5%). The control groups' scores for The Guide STUDENT PRE were already high at phase 1.

Regarding the MHLS score, subjects of the intervention group who had a low score at phase 1 were more likely to maintain a low score (45.8% vs. 35.7%). None of the individuals in the intervention group had differences in decreased scores compared to individuals in the control group (10.7%). Within the MHLS, a key outcome of interest, recognition of symptoms of depression (low mood for two or more weeks, loss of pleasure or interest in normal activities, or appetite and sleep change) was significantly higher after the intervention ($p = 0.0196$).

Finally, concerning the MHPK-10 score in the intervention group, the majority of those who had a low score at phase 1 maintained a low score at phase 2 (51.9%), unlike those in the control group (42.9%). Half of those with a high score at phase 1 reported a decreased score at phase 2 (50.0%) compared to 33.3% in the control group. Those in the intervention group who had a low score at phase 1 were more likely to have

Table 1: Comparison of MHL median scores from phase 1 to phase 2 across the intervention and the control groups

	Phase 1		Phase 2		*p*-value[a]
	Median	Quartiles	Median	Quartiles	
Intervention group ($n = 41$)					
Help-seeking intentions and behaviors—GHSQ (max score = 9)	3.5	3.0–5.0	5.0	3.5–5.5	0.073
Knowledge and beliefs about mental health—MHLS (max score = 160) ($n = 50$)[b]	117.0	111.0–124.0	121.0	114.0–128.0	0.066
Knowledge about mental health—revised Guide STUDENT PRE (max score = 13)	10.0	9.0–11.0	10.0	9.0–10.0	0.336
Positive mental health literacy—revised MHPK-10 (max score = 52)	41.0	37.0–44.0	41.0	37.0–43.0	0.799
Control group ($n = 29$)					
Help-seeking intentions and behaviors—GHSQ (max score = 9)	4.0	3.0–5.0	4.0	3.0–5.5	0.340
Knowledge and beliefs about mental health—MHLS (max score = 160) ($n = 51$)[b]	115	111.0–122.0	121	114.0–127.0	0.014
Knowledge about mental health—revised Guide STUDENT PRE (max score = 13)	9.0	9.0–11.0	10.0	8.0–10.0	0.533
Positive mental health literacy—revised MHPK-10 (max score = 52)	43.0	40.0–46.0	43.0	36.0–46.0	0.840

[a]Nonparametric Wilcoxon Median Comparison Test.
[b]Results are available for the whole samples, 50 and 51 participants, respectively.

increased their MHPK-10 score at phase 2 (37% vs. 28.6%). Moreover, 26.7% of those with a high score at phase 1 increased their score in the control group, compared with 7.1% of individuals in the intervention group.

Table 3 shows the results of the multivariate logistic regression analyses.

Integrating data from the semi-structured interviews

Thirty-five students (28 females) decided to follow the history of Laura, while 15 (11 females) followed the story of Lucas. Two students arrived at the final scene where Lucas commits suicide. Concerning the appreciation of the video, almost all students found the video captivating (48/50, 96.0%) and did not feel they were wasting their time (47/50, 94.0%). The vast majority of participants (36/50, 72.0%) identified with one of the two protagonists. Some students said: 'We can quickly identify with the characters because they are two students like us'; 'We put ourselves in people's shoes, and this brings us closer to the story, it familiarizes us with this kind of problems, which we know that exist in real life, but that, at the same time, are far from us'.

The vast majority of the students (42/50, 84.0%) would share and promote the video among their peers. During the interviews, students declared that both the topic and the format of the video were appealing, making it easy to disseminate among their friends. Finally, for almost all students (48/50, 96.0%), the video made them reflect on their attitudes in similar situations where a friend is showing depressive symptoms and suicidal warning sides. This result was consistent with the increased scores in the scales used in the questionnaire in the intervention group, especially on knowledge and beliefs about mental health.

All students (50/50) found that the interactive format was successful. They appreciated the originality of the format allowing them to become the actors of the video, reinforcing identification and information appraisal. Almost all participants (49/50, 98.0%) were satisfied with the fact of having choice points: 'It was really nice, it really engages us in the story'; 'The fact that it asks me to decide makes me more concerned'; 'Being able to interact is great. Beyond choosing, we really immerse ourselves in the characters' personalities. We are in it'; and 'It's super innovative'. However, one student pointed out the absence of nuances in the choices, suggesting that users would tend to choose a scenario because they believe that it is the 'right' option and not the 'true' answer reflecting how they would have behaved in reality: 'I feel a lack of nuances in the choice points, which will push people to provide the right answer, not their real

Table 2: Evolution by quartiles of MHL median scores from phase 1 to phase 2 within the intervention and the control groups

		GHSQ[a]—Phase 2											
		+1 Q		+2 or 3 Q		−1 Q		−2 or 3 Q		Q = −		Q = +	
		n	%	*n*	%	*n*	%	*n*	%	*N*	%	*n*	%
	GHSQ—Phase 1												
Intervention group	Score ≤4 (median)	6	25.0	8	33.3	2	8.3	–	–	8	33.3	–	–
(*n* = 41)	Score >4 (median)	1	5.9	–	–	3	17.6	1	5.9	–	–	12	70.6
Control group	Score ≤4 (median)	4	25.0	3	18.8	1	6.3	–	–	8	50.0	–	–
(*n* = 29)	Score >4 (median)	5	38.5	–	–	–	–	3	23.1	–	–	5	38.5
		The Guide Student Pre[b]—Phase 2											
		+1 Q		+2 or 3 Q		−1 Q		−2 or 3 Q		Q = −		Q = +	
		n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
	The Guide Student Pre-Phase 1												
Intervention group	Score ≤9 (median)	5	33.3	NA	NA	–	–	NA	NA	10	66.7	–	–
(*n* = 41)	Score >9 (median)	–	–	NA	NA	10	38.5	NA	NA	–	–	16	61.5
Control group	Score ≤9 (median)	5	31.3	NA	NA	–	–	NA	NA	11	68.8	—	
(*n* = 29)	Score >9 (median)	–	–	NA	NA	3	23.1	NA	NA	–	–	10	76.9
		MHLS[c]—Phase 2											
		+1 Q		+2 or 3 Q		−1 Q		−2 or 3 Q		Q = −		Q = +	
		n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
	MHLS—Phase 1												
Intervention group	Score ≤116 (median)	8	33.3	5	20.8	–	–	–	–	11	45.8	–	–
(*n* = 50)	Score >116 (median)	6	23.1	–	–	3	11.5	–	–	–	–	17	65.4
Control group	Score ≤116 (median)	7	25.0	8	28.6	3	10.7	–	–	10	35.7	–	–
(*n* = 51)	Score >4 (median)	6	26.1	–	–	2	8.7	–	–	–	–	15	65.2
		MHPK-10[d]—Phase 2											
		+1 Q		+2 or 3 Q		−1 Q		−2 or 3 Q		Q = −		Q = +	
		n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
	MHPK-10—Phase 1												
Intervention group	Score ≤42 (median)	10	37.0	–	–	3	11.1	–	–	14	51.9	–	–
(*n* = 41)	Score >42 (median)	1	7.1	–	–	4	28.6	3	21.4	–	–	6	42.9
Control group	Score ≤42 (median)	2	14.3	2	14.3	4	28.6	–	–	6	42.9	–	–
(*n* = 29)	Score >42 (median)	4	26.7	–	–	2	13.3	3	20.0	–	–	6	40.0

[a]First quartile [0–3]; second quartile [3–4]; third quartile [4–5]; fourth quartile >5.
[b]First quartile [0–9]; second quartile >9.
[c]First quartile [0–111]; second quartile [111–116]; third quartile [116–124]; fourth quartile >124.
[d]First quartile [0–39]; second quartile [39–42]; third quartile [42–45]; fourth quartile >45.
NA, not applicable.

answer'. This might have been accentuated by the fact that the lab reviewer was present during the intervention. A total of 88.0% (44/50) of students would have liked watching more interactive videos on other health subjects.

Participants found the video was neither too long nor too short. Some students declared that they would re-watch the video in order to test the other character to get a different point of view. As for the video making quality, 90.0% (45/50) of students were fine with it. Only two students reported that they were bothered by the lack of quality of support (e.g., bad audio) and seven of them found the scenario too simple.

Regarding the increase in mental health knowledge, students had different opinions. Half of the interviewed students declared they had increased their knowledge about mental health: 'Yes, I have improved my knowledge, because, in the end, I didn't know much about it. It's not a topic we're regularly interested in, except when it happens to us or to someone close to us'. The video allowed these students to learn more about depression and suicide risk. Depression was recognized as a

Table 3: Effect of intervention and sex on the MHLS scales, estimated with a multivariate logistic regression analysis

	GHSQ (≥ 4.5 vs. < 4.5)			*MHLS (≥ 122.5 vs. < 122.5)*			*The Guide STUDENT PRE (≥ 10 vs. < 10)*			*MHPK-10 (≥ 41 vs. < 41)*		
	OR[a]	(95% CI)[b]	p[c]	OR[a]	(95% CI)[c]	p[c]	OR[a]	(95% CI)[b]	p[c]	OR[a]	(95% CI)[b]	p[c]
Intervention vs. Control	1.922	[0.585; 6.315]	0.282	0.203	[0.044; 0.938]	0.041	0.900	[0.313; 2.587]	0.844	0.904	[0.272; 3.001]	0.867
Sex (female vs. male)	3.353	[0.693; 16.220]	0.132	0.329	[0.050; 2.161]	0.247	1.317	[0.327; 5.313]	0.698	5.776	[1.007; 33.146]	0.049
Self-rated mental health (good vs. bad)	0.860	[0.214; 3.460]	0.832	2.646	[0.531; 13.171]	0.235	1.176	[0.321; 4.307]	0.807	4.603	[0.986; 21.488]	0.052
K6 score after intervention (≥ 7 vs. < 7)	0.529	[0.139; 2.019]	0.352	0.207	[0.037; 1.155]	0.073	1.212	[0.350; 4.195]	0.762	0.521	[0.126; 2.152]	0.368
Diagnosis of a mental health problem (yes vs. no)	1.243	[0.298; 5.188]	0.766	0.383	[0.060; 2.449]	0.311	0.539	[0.143; 2.029]	0.361	0.780	[0.170; 3.583]	0.749
Medication for anxiety, anguish and stress (yes vs. no)	0.685	[0.128; 3.665]	0.659	2.504	[0.384; 16.320]	0.337	1.741	[0.340; 8.905]	0.505	2.108	[0.320; 13.864]	0.438
Talk to a health professional (yes vs. no)	1.873	[0.412; 8.521]	0.417	1.260	[0.239; 6.647]	0.785	0.559	[0.148; 2.114]	0.392	0.744	[0.158; 3.504]	0.709
Year of study (1st vs. ≥ 2nd)	0.452	[0.109; 1.882]	0.275	1.076	[0.220; 5.254]	0.928	0.635	[0.163; 2.466]	0.511	0.778	[0.172; 3.517]	0.744
GHS baseline score (≥ 4 vs. < 4)	10.351	[2.812; 38.104]	<0.001	–	–	–	–	–	–	–	–	–
MHLS baseline score (≥ 116 vs. < 116)	–	–	–	19.281	[4.303; 86.406]	<0.001	–	–	–	–	–	–
TGSP baseline score (≥ 9 vs. < 9)	–	–	–	–	–	–	3.972	[0.792; 19.928]	0.0937	–	–	–
MHPK-10 baseline score (≥ 42 vs. < 42)	–	–	–	–	–	–	–	–	–	11.881	[2.608; 54.134]	0.001

[a]Odd ratio.
[b]95% confidence interval.
[c]p-value.

hidden condition which is important to discuss and should not be considered as a taboo. Concerning suicide, students learned that talking about suicide can help avoid harmful behaviors.

Results concerning this sub-sample were coherent with the increase in the MHLS score as well as in the GHSQ reported by the quantitative data. Seven students declared they had not learned any new health information after watching the video: 'No, [I didn't learn something new] because I was already informed. But I don't think that is the case for everyone'. These students had already experienced a similar situation: 'There are things I already knew because of my personal experience. But I think the video can be really instructive. Like, for example, the fact that it suggests that talking about suicide doesn't lead to suicide and that, on the contrary, you have to talk about it to fight it'. One student said she would have liked having more mental health-related information. Declarations from these students might explain the moderate results of the quantitative phase.

Concerning help-seeking behavior, half of the students felt they had learned how to behave with a friend in difficulty or how to recognize certain signs of fragility in themselves or in the others. Some participants wondered about their previous behavior and their willingness to react differently in the future: 'So I think I learned a little bit. I think if it happens to me, I'll be careful to talk more about it around me. Because I tend to stay locked up when I have problems. I think I'll talk about it more'. Also, they de-dramatized the image of the mental health professionals with some students expressing a desire to be informed about the offer of care available in their city: 'For example, advising him [Lucas] to go to a doctor wouldn't necessarily have occurred to me all of a sudden. It's not a bad idea at all, we can't fix it ourselves. So recurring to professionals who are used to managing these problems, who know how to do it, and know how to monitor the situation is much more reassuring for the person in danger'. This was reflected in the increase in the GHSQ score.

Finally, concerning stigma and stereotypes about mental health, some students declared that the video shed light on mental health, thus facilitating discussions around it with relatives and health professionals. Participants said that the video helped in breaking taboos and prejudices: 'In fact, it just made me realize that mental health problems really exist. That there are really cases like this and we don't realize it'. Participants reflected on stereotypes and learned that talking about suicide does not lead people to act. They also understood that depression and suicide exist, the message being to talk about it. This was in line with the increase in the MHLS score.

DISCUSSION

Principal findings

Results from the questionnaires showed that medians of the scores of four MHL scales increased or remained stable in the intervention group after viewing the video. In particular, the GHSQ score increased (1.5 points) suggesting that the video might have positively influenced the viewers' will to seek for help if presenting a mental health problem. The MHLS also increased (4 points): this scale contains several items on recognition of troubles as well as stigmatization. The video might have supported students in better understanding symptoms of mental health distress and contributed to reduced stereotypes and prejudices. In particular, regarding knowledge of depression, scores increased during phase 2. However, both GHSQ and MHLS baseline median scores were relatively low: 3.5 out of 9 for the GHSQ and 117 out of 160 for the MHLS. These results suggest the need for further interventions to increase MHL in students, especially concerning help-seeking and recognizing troubles and stigmatization. The absence of any increase in the revised Guide STUDENT PRE might be justified by the fact that all participating students already had a basic knowledge of mental health in general, due to previous school training. Positive MHL also remained stable: the intervention did not change participants' beliefs about good attitudes and behaviors to promote mental health. An additional reason explaining the limited difference between the intervention and control groups may be that the control was also presented with an intervention, albeit a less interactive one. Thus, both control and treatment could be expected to show some improvement, but the starting point of already rather high background literacy prevents the emergence of a clear difference and is hampered by the small sample size.

In parallel, we also observed an increase in the median of the MHLS score in the control group. In general, results pre- and post-test within the intervention group were encouraging (i.e. increase or stabilization of the MHL scores), but the comparison with the control group did not produce similar positive results. This must be interpreted considering the small sample of this study which was a pilot reduced by several missing values. Given the limited number of individuals in the two groups and obtained results, we calculated the statistical power values. They were actually low (under 0.80) and

this might explain the lack of significance in almost all analyses. We must also consider that the control group already presented good MHL scores at the baseline, thus interfering with final interpretation. In fact, it is possible that all participants to the study were more sensitive to the topic of MHL. For this reason, we explored the evolution of the scores before and after the intervention to consider the baseline scores in each group.

Despite the fact that results were not robust for the quantitative phase, they can be better interpreted in the light of the qualitative data we collected through the semi-structured interviews. We observed that students were almost all satisfied with the format and design of the video. Some of the participants declared having learned more about mental health, while others were already acquainted with mental health problems. Qualitative data was also useful to collect advice and suggestions for future similar interventions. Most participants in the intervention condition reported that they were satisfied with the video and rated their appreciation particularly highly. A key element of the appreciation of the video was the identification with the characters. Narratives can be more persuasive if users identify with the characters (i.e. role models), thus boosting learning and retention of key messages. The more the user identifies with the character, the more the video is appreciated since users feel the intervention is personalized and tailored on their habits.

Results partially confirmed our hypotheses. First, the interactive video slightly enhanced students' knowledge of mental health problems (increased MHLS score, stable Guide STUDENT PRE). Second, students' mental health help-seeking behaviors were also promoted (increased GHSQ score). Third, the interactive video decreased students' stigma and misconceptions about mental health (increased MHLS score).

Comparison with the literature

Our results may be compared with other studies conducted in other University campuses to improve students' MHL. A cluster-randomized trial assessing a multifaceted intervention on MHL in several campus in Melbourne, Australia (Reavley *et al.*, 2014), showed no effects in MHL, help-seeking for mental health problems, nor mental health first aid given to family or friends in psychological distress. The almost null effect of the intervention might be explained by the fact that it was based on emails, posters, campus events, factsheets/booklets and mental health first aid training courses which did not include a digital interactive approach. In fact, our results tended to confirm our hypothesis that the interactive video could leverage viewers' sense of commitment and participation, as well as, their power of choosing and leading the action to enhance learning of the subject addressed by the video. This is in line with outcomes from a previous review on web-based interventions targeting MHL (Brijnath *et al.*, 2016a) demonstrating that such interventions are generally efficacious when they include 'active ingredients' like a pedagogical approach that promotes interactivity and experiential learning. For instance, at the University of Hong Kong, a web-based social network electronic game was effective in promoting the MHL of 73 undergraduates thanks to its interactive approach (Li *et al.*, 2013). A randomized trial conducted in Norway showed that an internet-based self-help intervention for the prevention of depression was effective in reducing symptoms of depression and negative thoughts and in increasing depression literacy in students (Lintvedt *et al.*, 2013). Participants reported high satisfaction stating that they found the intervention useful and would recommend it to their peers. The online format was particularly appreciated. Other studies have partially evaluated MHL interventions not using a controlled design (Brijnath *et al.*, 2016; Jorm, 2019). Our pilot study has the strength of providing reliable mixed-methods data from an experiment. In fact, as suggested by Kutcher and colleagues (Kutcher *et al.*, 2016), MHL interventions are effective if they are contextually appropriate and evaluated through validated measurements. For this, in order to carefully consider the context of our digital intervention, we used a co-construction approach. Furthermore, we employed validated scales, thus producing reliable evidence of the effectiveness of our intervention.

Strengths and limitations

Strengths of this pilot study included the uniqueness of the intervention, that is, an interactive video available publicly online which had been co-constructed by several stakeholders. Furthermore, this was one of the first studies evaluating the effect of a digital intervention on MHL through a mixed-methods, randomized controlled design, utilizing validated MHL scales and interviews. The complementarity of these two types of data substantially helped the interpretation of the results. Qualitative data in particular underlined students' strong appreciation for the intervention.

The loss of data for 31 participants for some outcomes was the main limitation of this study as missing data could have considerably impacted final results. Given the small sample, statistical power was low and differences did not reach statistical significance. However, we observed intra-group modification from

phase 1 to phase 2 by evaluating the general increase or decrease of MHL medians scores. It is also true that since this was a pilot study, a small sample size was sufficient. We could also observe trends in the results, even if these data must be data interpreted cautiously. A second limitation was a potentially biased sample. Participants were self-selected and might have been already interested in mental health, thus not representing lay students. A third limitation was the absence of a specific indicator in the total scale on knowledge of suicide risk, while being a core topic in the video. This is due to the fact that the scale we used was created independently from and prior to the video making. Fourth, the two interventions, that is, the interactive video and the brochures, were different in nature but addressed the same topic, which might have biased findings since they both make students aware of mental health issues. However, the hypothesis of the study was that the interactive video had a higher impact on student's MHL, as partially shown in the results. Finally, the intervention concerned only University students. This study raises the question of the effectiveness of similar programs in non-students who are also (and at higher rates) affected by mental health problems (Case and Deaton, 2020). As a highly educated population, University students might present higher MHL levels than their peers and this must be taken into account when interpreting results of this study. This work is then to be considered as a pilot study for a broader intervention addressing young adults.

CONCLUSIONS AND IMPLICATIONS

Our study showed that an interactive video aimed at enhancing MHL can provide benefit for students who are generally exposed to the risk of mental distress, an issue which is of particular importance given its exponential growth in student populations. Based on our results, interventions are appreciated if they are web-based (thus accessible anywhere anytime) and interactive.

Caution is warranted in generalizing our findings to other settings. We especially suggest to conduct further studies evaluating this tool in larger samples with higher statistical power. The design we used (two-group pre–post randomized controlled trial) was perhaps too sophisticated and more simplified designs (e.g. pre-/post-test) can be sufficient to provide consistent results. Nevertheless, qualitative data showed that the online format of the intervention provides a useful opportunity to reach without time, space and cost constraints for students across France and possibly worldwide. Since we provided evidence that the interactive digital-based format was appreciated by students, future interventions in University campuses might use such a format to deliver effective programs targeting MHL.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Health Promotion International* online.

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ETHICS APPROVAL

The whole project was approved by the national ethics committee (Comité de protection des personnes, Direction générale de la santé) as a noninvasive intervention conducted on a voluntary basis. Data were stored and analyzed in compliance with the EU General Data Protection Regulation (GDPR). The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

INFORMED CONSENT

Before starting the completion of the baseline questionnaire, students were asked to sign a consent form informing them of the different phases of the project. Only students participating to the intervention phase were asked to sign a supplementary consent form asking their permission to record the semi-structured interviews. As an incentive, all 482 participants to the baseline phase were given two cinema tickets. The 101 participants to the intervention phase were given a supplementary

10-euro shopping gift card. All results were anonymized. At the end of both the interventions, all students, including those in distress, were given information of the existence of free mental health services including the University Student's Health service. The psychologist of the research unit promoting the study was available if needed.

CONFLICT OF INTEREST STATEMENT

The Authors declare that there is no conflict of interest.

DATA AVAILABILITY

The datasets generated for this study are available on request to the corresponding author.

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