

## **"Using Rayyan's functionalities beyond title and abstract screening: developing guidelines for textual analysis"**

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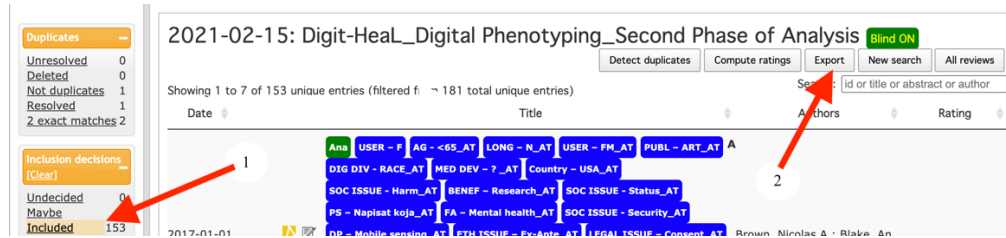
Regardless of whether a literature review is narrative, exploratory or systematic, it draws on a large number of research studies as input. Its scope and methodological requirements are such that carrying it out requires the involvement of various stakeholders (often a team of researchers) and a significant time commitment. Fortunately, there are today several types of software that assist scholars in the analysis process. For our exploratory review of the literature on the ELSI of Digital Phenotyping in healthcare, our research team has identified a free online software to assist in the analysis process, Rayyan QCRI (Ouzzani et al, 2016).

In the initial phase (title and abstract screening), Rayyan proved to be stable, useful, efficient and user-friendly, and shortened the time required for the selection stage of our scoping review. Once a successful double-blind screening of titles and abstracts was completed, the research team agreed to further explore Rayyan's functionalities with the aim of adapting them to the second phase of the analysis: the charting of data and data extraction. In an effort to communicate our experience of using Rayyan for the second phase of our scoping review to the scientific community, and to encourage a discussion about Rayyan's further developments, we have chosen to publish this short manual. As there are existing tutorials for the first phase (ibid) that new users can refer to, we will only focus here on the second phase of full-text screening, addressing scholars who are already familiar with Rayyan for title and abstract screening.

### **Steps for the second phase of a literature review using Rayyan:**

1. Once the first phase of the analysis has been completed, a selection of the main sources should have been established, as previously selected sources will be analysed in the second phase.
2. Retrieve available PDFs for all selected publications. Proceeding with the PDF search at this stage will avoid the burden of having to exclude publications for which your research team was not able to find available full texts.
3. Extract the references of included articles selected over the first phase - in EndNote, ris format, or other depending on your reference manager. You can do so as outlined in Fig. 1 - you will receive a download link from Rayyan in your registration email.

Fig. 1



4. Merge your .ris files into a single library in your reference manager (JabRef, Zotero, etc).
5. Add your snowballing references to that library. You can alternatively upload additional references into Rayyan at a later stage.
6. Extract the new (merged) library.
7. Upload it into a "New Review" in Rayyan. Name it accordingly.
8. Invite (a) collaborator (s)
9. Upload PDFs (Public/Private) – if you are unsure about copyrights, we recommend choosing the "private" option.  
You can upload PDFs in bulk. Simply select several references or articles at once using your keyboard and mouse or just the keyboard as explained here (<https://rayyan.qcri.org/guides/keyboard>) and then click on "Download full text PDFs". You can then download the PDFs from your local drive and associate each title with the correct file name.
10. As each literature review has its own organisational structure (no fixed framework), a functionality that allows for such flexibility comes in handy. Making use of the "Labels" functionality to articulate and link all the literature items together will allow for a clear and comprehensive data charting you can update as you go. The Labels become your codes/indicators, as shown in Fig.2 and Fig.3

Fig. 2 – Label list indicating the number of publications labelled as such.

Labels	
<u>PUBL – ART_AT</u>	119
<u>BENEF – Patient_AT</u>	112
<u>PS – Napisat koja_AT</u>	97
<u>EP – Quality of life_AT</u>	72
<u>ETH ISSUE – Ex-Ante_AT</u>	67
<u>ETH ISSUE - Privacy_AT</u>	67
<u>Country – USA_AT</u>	60
<u>TECH – PRIV SECT_AT</u>	59
<u>FA – General health_AT</u>	57
<u>ETH ISSUE – Ex-Post_AT</u>	55
<u>MED DEV- N_AT</u>	53
<u>BENEF – Industry_AT</u>	53
<u>EP Information_AT</u>	50
<u>TAG QUAL_AT</u>	48
<u>USER – FM_AT</u>	48
<u>DGN – Theoretical_AT</u>	48
<u>FA – Physical health_AT</u>	47
<u>FA – Mental health_AT</u>	46
<u>LONG – N_AT</u>	43
<u>DGN – Empirical/Descriptive_AT</u>	43
<u>DS – Interdisciplinary_AT</u>	41
<u>ELS ISSUE_AT</u>	39
<u>BENEF – Research_AT</u>	37
<u>LEG ISSUE - Unregulated_AT</u>	36
<u>ETH ISSUE – Novelty/Lack of research_AT</u>	36
<u>EP – Goal setting Behaviavioural changes_AT</u>	35
<u>DGN – Empirical/Quasi-Experimental_AT</u>	35
<u>SOC ISSUE – Adoptability_AT</u>	35
<u>MED DEV – ?_AT</u>	33

Fig.3. - Label list as seen within the publication window with blind mode on (only one reader's labels are visible)

2021-02-15: Digit-Heal\_Digital Phenotyping\_Second Phase of Analysis Blind ON

Detect duplicates    Compute ratings    Export    New search    All reviews

Showing 1 to 2 of 9 unique entries (filtered from 181 total unique entries)    Search:

Date	Title	Authors	Rating
2018-01-01	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> <span style="background-color: green; color: white; padding: 2px;">Ana</span> <span style="background-color: blue; color: white; padding: 2px;">ELS ISSUE_AT</span> <span style="background-color: blue; color: white; padding: 2px;">MED DEV- N_AT</span> <span style="background-color: blue; color: white; padding: 2px;">PUBL – ART_AT</span> <span style="background-color: blue; color: white; padding: 2px;">MED DEV – Y_AT</span> <span style="background-color: blue; color: white; padding: 2px;">Data mini...</span> </div> <div style="display: flex; flex-wrap: wrap; gap: 5px; margin-top: 5px;"> <span style="background-color: blue; color: white; padding: 2px;">Country – USA_AT</span> <span style="background-color: blue; color: white; padding: 2px;">BENEF – Patient_AT</span> <span style="background-color: blue; color: white; padding: 2px;">BENEF – Society_AT</span> <span style="background-color: blue; color: white; padding: 2px;">BENEF – Industry_AT</span> </div> <div style="display: flex; flex-wrap: wrap; gap: 5px; margin-top: 5px;"> <span style="background-color: blue; color: white; padding: 2px;">BENEF – Research_AT</span> <span style="background-color: blue; color: white; padding: 2px;">TECH - Smartphones_AT</span> <span style="background-color: blue; color: white; padding: 2px;">TECH – PRIV SECT_AT</span> </div> <div style="display: flex; flex-wrap: wrap; gap: 5px; margin-top: 5px;"> <span style="background-color: blue; color: white; padding: 2px;">TECH – PUBL SECT_AT</span> <span style="background-color: blue; color: white; padding: 2px;">DGN – Theoretical_AT</span> <span style="background-color: blue; color: white; padding: 2px;">LEG ISSUE - Privacy_AT</span> </div> <div style="display: flex; flex-wrap: wrap; gap: 5px; margin-top: 5px;"> <span style="background-color: blue; color: white; padding: 2px;">PS – Napisat koja_AT</span> <span style="background-color: blue; color: white; padding: 2px;">FA – Mental health_AT</span> <span style="background-color: blue; color: white; padding: 2px;">ETH ISSUE – Consent_AT</span> </div> <div style="display: flex; flex-wrap: wrap; gap: 5px; margin-top: 5px;"> <span style="background-color: blue; color: white; padding: 2px;">FA – General health_AT</span> <span style="background-color: blue; color: white; padding: 2px;">BENEF – Practitioner_AT</span> <span style="background-color: blue; color: white; padding: 2px;">DP - Digital phenotype_AT</span> </div> <div style="display: flex; flex-wrap: wrap; gap: 5px; margin-top: 5px;"> <span style="background-color: blue; color: white; padding: 2px;">EP – Quality of life_AT</span> <span style="background-color: blue; color: white; padding: 2px;">LEG ISSUE - Unregulated_AT</span> <span style="background-color: blue; color: white; padding: 2px;">DS – Interdisciplinary_AT</span> </div> <div style="display: flex; flex-wrap: wrap; gap: 5px; margin-top: 5px;"> <span style="background-color: blue; color: white; padding: 2px;">SOC ISSUE - Transparency_AT</span> <span style="background-color: blue; color: white; padding: 2px;">SOC ISSUE – Inequality_AT</span> </div>		

11. For consistency, note that each collaborator must insert the same label list (on which they will have previously agreed upon, and expand it along the analysis). We have found it useful that each collaborator appends the name of the indicator with their

initials/name, so that once the blind mode is lifted, and both readers' indicators (labels) become visible for each publication, it remains clear which collaborator labelled the publications with said indicator (Fig.4). That will simplify the comparison phase.

Fig. 4

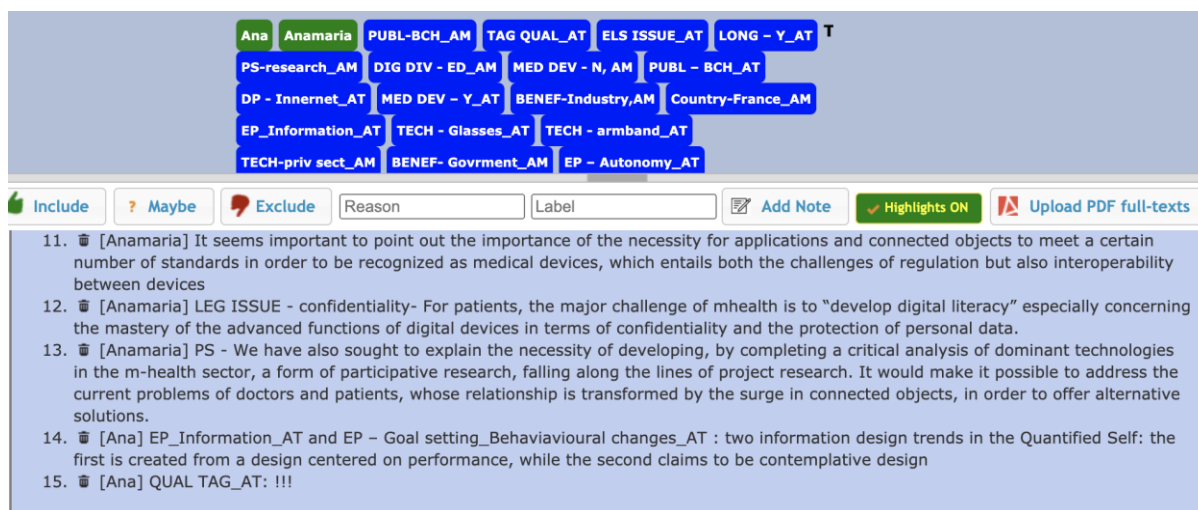
2021-02-15: Digit-HeaL\_Digital Phenotyping\_Second Phase of Analysis Blind OFF

Showing 1 to 7 of 147 unique entries (filtered from 181 total unique entries) Search:

Date	Title	Authors	Rating
2017-01-01	<div style="background-color: #007bff; color: white; padding: 2px;">Ana</div> <div style="background-color: #007bff; color: white; padding: 2px;">Anamaria</div> <div style="background-color: #007bff; color: white; padding: 2px;">USER - F</div> <div style="background-color: #007bff; color: white; padding: 2px;">AG - &lt;65_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">AG- &lt;65, AM</div> <div style="background-color: #007bff; color: white; padding: 2px;">USER-FM, AM</div> <div style="background-color: #007bff; color: white; padding: 2px;">A Sna...</div> <div style="background-color: #007bff; color: white; padding: 2px;">PUBL-ART, AM</div> <div style="background-color: #007bff; color: white; padding: 2px;">LONG - N_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">USER - FM_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">Country-USA, AM</div> <div style="background-color: #007bff; color: white; padding: 2px;">PUBL - ART_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">DS-psychology_AM</div> <div style="background-color: #007bff; color: white; padding: 2px;">DIG DIV - RACE_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">MED DEV - ?_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">Country - USA_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">SOC ISSUE - Harm_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">BENEF - Research_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">ETH ISSUE- Ex-post_AM</div> <div style="background-color: #007bff; color: white; padding: 2px;">SOC ISSUE - Status_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">DP- Quantified Self_AM</div> <div style="background-color: #007bff; color: white; padding: 2px;">PS - Napisat koja_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">FA - Mental health_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">SOC ISSUE - Security_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">DP - Mobile sensing_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">ETH ISSUE - Ex-Ante_AT</div> <div style="background-color: #007bff; color: white; padding: 2px;">TECH-wearable cameras_AM</div> <div style="background-color: #007bff; color: white; padding: 2px;">LEGAL ISSUE - Consent_AT</div>	Brown, Nicolas A.; Blake, An...	

12. In the "Notes" button of each publication: readers can copy the excerpt that corresponds to an indicator and paste it into the Notes section. They will write down the name of the corresponding indicator (code). The name of the collaborator who made the note will automatically appear upon saving the note. Collaborators will not be able to see each other's notes until the blind mode is lifted, as shown in Fig. 5.

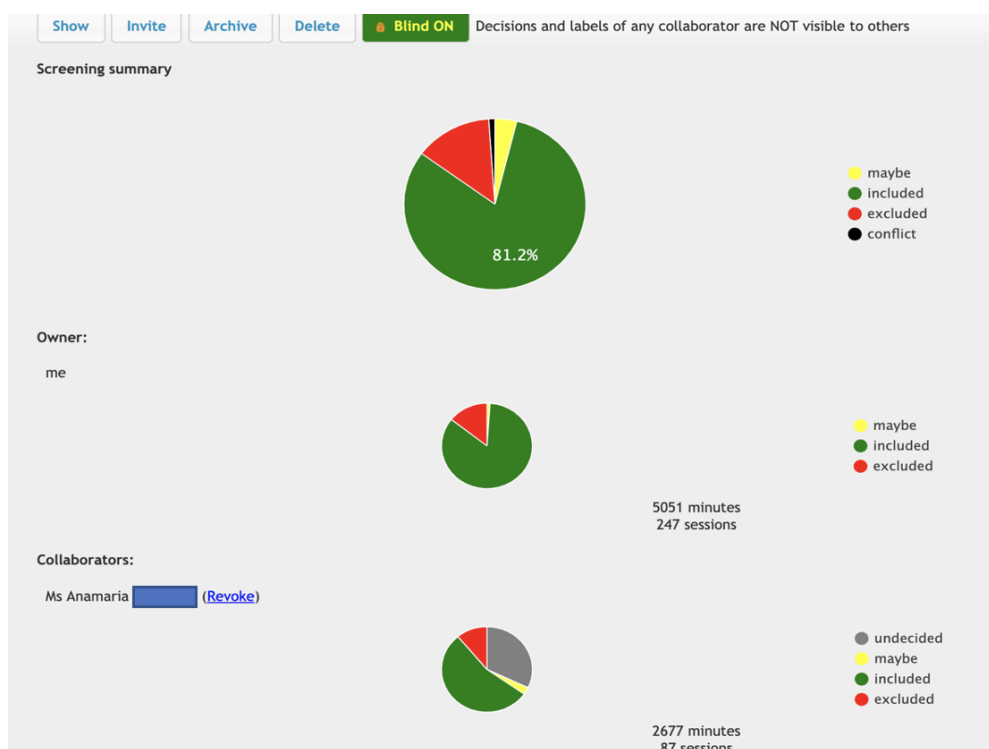
Fig. 5



The screenshot shows a list of publications with various labels. The labels include: Ana, Anamaria, PUBL-BCH\_AM, TAG QUAL\_AT, ELS ISSUE\_AT, LONG - Y\_AT, PS-research\_AM, DIG DIV - ED\_AM, MED DEV - N, AM, PUBL - BCH\_AT, DP - Internet\_AT, MED DEV - Y\_AT, BENEF-Industry,AM, Country-France\_AM, EP\_Information\_AT, TECH - Glasses\_AT, TECH - armband\_AT, TECH-priv sect\_AM, BENEF- Govrment\_AM, EP - Autonomy\_AT. Below the list are buttons for 'Include', 'Maybe', 'Exclude', 'Add Note', 'Highlights ON', and 'Upload PDF full-texts'. The list contains 15 items, with the first three items having expandable details.

13. After each completed publication analysis, readers will label it with the "include" button – this will give an overview of work progress, as seen below in Fig. 6.

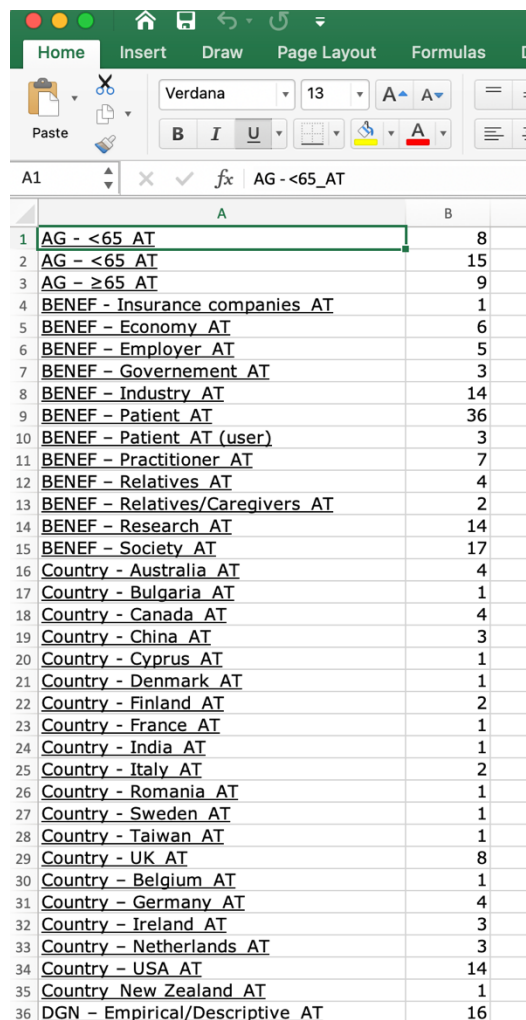
Fig.6



14. Once all references are "Included", the blind mode can be lifted and readers can proceed with conflict resolution and discuss disagreements.

15. Data extraction can be done by selecting the label (one or many) within the label list and pasting it into excel for descriptive analysis, as shown in Fig. 7.

Fig.7



	A	B
1	AG - <65 AT	8
2	AG - <65 AT	15
3	AG - ≥65 AT	9
4	BENEF - Insurance companies AT	1
5	BENEF - Economy AT	6
6	BENEF - Employer AT	5
7	BENEF - Government AT	3
8	BENEF - Industry AT	14
9	BENEF - Patient AT	36
10	BENEF - Patient AT (user)	3
11	BENEF - Practitioner AT	7
12	BENEF - Relatives AT	4
13	BENEF - Relatives/Caregivers AT	2
14	BENEF - Research AT	14
15	BENEF - Society AT	17
16	Country - Australia AT	4
17	Country - Bulgaria AT	1
18	Country - Canada AT	4
19	Country - China AT	3
20	Country - Cyprus AT	1
21	Country - Denmark AT	1
22	Country - Finland AT	2
23	Country - France AT	1
24	Country - India AT	1
25	Country - Italy AT	2
26	Country - Romania AT	1
27	Country - Sweden AT	1
28	Country - Taiwan AT	1
29	Country - UK AT	8
30	Country - Belgium AT	1
31	Country - Germany AT	4
32	Country - Ireland AT	3
33	Country - Netherlands AT	3
34	Country - USA AT	14
35	Country New Zealand AT	1
36	DGN - Empirical/Descriptive AT	16

## Conclusions

### Negative aspects:

- i. PDFs cannot be retrieved directly from Rayyan
- ii. Uploaded PDFs are not editable.
- iii. PDFs cannot be autocoded (a function available in Nvivo, for example) and PDF data cannot be used to produce word frequencies nor exported into graphs, word clouds etc.
- iv. Automated functionalities imagined as tools for the first phase of analysis (title and abstract screening), such as *automated rating* have proved useless for the second phase of analysis (textual analysis).
- v. The time count in the screening summary window appears to be inaccurate.

### Positive aspects:

- i. Free online software
- ii. A mobile application (link) is available for both OS and Android
- iii. User-friendly
- iv. Can be coherently used as sole software throughout the first and second phase
- v. Allows for blind reviewing in the first and second phase
- vi. Labels can be used as nodes (in Nvivo, for example), but allows for many users to work on a single publication simultaneously without the need for several licences.

Rayyan's functionalities proved to be a flexible and helpful tool for both phases of our scoping review. Several of the negative aspects we highlighted in these guidelines have already been raised by various users on Rayyan's support web pages. We are confident Rayyan's developers will take their user's comments into account in the near future and adapt its functionalities for textual analysis. Until then, Rayyan's flexible toolkit can be tweaked as described to serve this purpose.

### Suggestions for further reading:

- Harrison, H., Griffin, S. J., Kuhn, I., & Usher-Smith, J. A. (2020). Software tools to support title and abstract screening for systematic reviews in healthcare: an evaluation. *BMC medical research methodology*, 20(1), 1-12.
- Johnson, N., & Phillips, M. (2018). Rayyan for systematic reviews. *Journal of Electronic Resources Librarianship*, 30(1), 46-48.
- Kellermeyer, L., Harnke, B., & Knight, S. (2018). Covidence and rayyan. *Journal of the Medical Library Association: JMLA*, 106(4), 580.

### Online resources:

<https://rayyan.ai>

<http://support.rayyan.qcri.org/forums/232525-general/filters/new?page=6>

<https://social.rayyan.ai>

### References

- Ouzzani, M., Hammady, H., Fedorowicz, Z. et al. (2016). Rayyan—a web and mobile app for systematic reviews. *Syst Rev* 5, 210, <https://doi.org/10.1186/s13643-016-0384-4>