PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Leverage Points to Improve Smoking Cessation Treatment in a Large Tertiary Care Hospital: A Systems-Based Mixed Methods Study
AUTHORS	Ramsey, Alex; Prentice, Donna; Ballard, Ellis; Chen, Li-Shiun; Bierut, Laura J.

VERSION 1 - REVIEW

REVIEWER	Charis Girvalaki Medical School University of Crete, Greece
REVIEW RETURNED	05-Apr-2019

GENERAL COMMENTS	This study provides valuable data regarding the in-hospital tobacco treatment delivery, highlighting important barriers in its successful implementation. This study also reveals that even screening for smoking behavior which is identified as a priority for all patients by the WHO is not performed. Another important finding supports a very common misperception of the healthcare professionals regarding their patients' willingness to quit and an overreporting of their performance in 5As when compared with patient data which are considered to be more reliable according to previous studies. Low rates for 5As implementation is also an alarming event for the necessity of protocols for brief councelling and pharmacotherapy treatment as a standard procedure for all smoker patients, training for all healthcare professionals especially in behavioral technics which will reduce patients' resistance and defined roles of healthcare professionals. This manuscript is is well-written, the study is well designed and included mixed methods study with qualitative and quantitative data sources. Some minor comments are: 1) Line 28 Methods: Gives the reader the impression that patients were approached after they were discharged from the hospital while after that it is mentioned that patients were interviewed while they were hospitalized. It would be useful to clarify this 2) Line 13 Methods: If patients from psychiatry were included this could possibly be a confounder as smoking prevalence is higher in this patient group and also perceptions of healthcare professionals are mistaken as many think that this is a high risk population and that smoking cessation could worsen the symptoms of the mental health illness so 5As and brief counselling are not very common as a practice. Please clarify this or include it in the limitation section

REVIEWER	Joanna Streck University of Vermont, USA
REVIEW RETURNED	10-Apr-2019

GENERAL COMMENTS	This is a well-written article reporting on the results of a mixed method (quantitative and qualitative) study seeking to identify strategies to improve smoking cessation treatment offering and utilization in a midwestern hospital-an important topic to address. Enthusiasm for this manuscript would be strengthened if the below concerns were addressed, particularly comments related to the novelty of this project and how this adds to the larger literature. Major Concerns: 1. The introduction should better quantify the scope of the problem being addressed in this paper. For example, it would be helpful to reference what this study is adding to the literature and why this study is needed (in the context of the other published studies addressing smoking cessation practices among hospitalized smokers and providers which should be cited when relevant). Further, while the scope of the problem at BJH is clear, the larger scope of this project (and fit with broader literature) needs to be clarified. 2. Methods: “We then reconvened a select group of participants from the initial sessions..”- How was this smaller group selected? What is the rationale for taking this approach? Is it supported by the literature? 3. Results: It would be helpful if section headers in results more clearly described what question/prompt each of the results sections is referring to. For example, for “system insights,” it is not clear what providers and patients are responding to here and what question is being addressed with the results presented. Additionally, for “Action ideas” are these generated by the authors? Or are these ideas that patients/providers are responding to in interviews? If it is driven by the authors then this section seems more suited for discussion/conclusions. 4. I do not see a statistical methods section but this would be helpful given that some quantitative methods were employed and I only see them addressed in the results. Missing data, if applicable, should be discussed. 5. Discussion: Similar to comment #1 above, the discussion section should highlight the novelty of this project and what this project is adding to the broader literature and clinically as well as compare current findings with what has already been published on this topic a. Conclusions: For example, the italicized and numbered conclusions are strategies already employed and studied at various large hospitals. Do these conclusions just apply to BJH then? If not, larger implications should be discussed. Minor Concerns: 1. Introduction: “smoking prevalence remains high among those entering hospital settings.” What is the comparator in this sentence? The general population? Also why is this the case? Because those with chronic conditions have higher prevalence of smoking. 2. Introduction: Terminology “leverage points” should be clarified 3. Study purpose: “determinants of treatment utilization.” The use of the word utilization suggests that the study is addressing a

	patient issue vs. the prior paragraph which details an issue on the provider end (offering services). Study purpose could benefit from clarification. a. Additionally, it seems that the purpose of this study is limited to addressing cessation treatment delivery at BJH, but would be helpful to note the purpose of the study more broadly in the scope of the broader literature on this topic 4. Methods: Patients were recruited in a "diverse set of services." Should be detailed somewhere which services these were and which were not represented and why (non response etc) 5. Methods: "research participant registry." This should be noted in the limitations section as recruitment was limited to this vs all patients 6. Methods (page 6): In the second paragraph it would be helpful to separate provider vs patient interview questions. It would also be helpful to upload the structured interview as a supplemental document. 7. Phase II: Online Survey (page 7): Unclear which are qualitative vs quantitative assessments 8. Page 7 bolded headings: I would add in words "patient" and "providers" to further clarify and orient reader 9. Page 8 "reflecting the underlying population of patients…"-What is the comparator in this sentence? 10. Page 8 "patients were asked about their smoking behaviors…"-Specific measures should be detailed here and if they stem from the literature (e.g., FTND) citations should be included. For example, one table discussed e-cigarette use in results, but I do not see mention of data collection instruments for e-cigarette use in this methods section. 11. Page 8, "Patient and public involvement" section- This section header is confusing and seems a bit misaligned with the content of this section. It seems this section is discussing the ways in which qualitative work informed quantitative work? 12. Page 9 "we plan to disseminate results of this study to patients…"-How is this different than any other study that is published and presented at a conference? This section seems unconventional and not sure what it is adding. Appreciate the opportunity to review this manuscript.

VERSION 1 – AUTHOR RESPONSE

Reviewer(s)' Comments to Author:

Reviewer: 1

Reviewer Name: Charis Girvalaki

Institution and Country: Medical School University of Crete, Greece

Please state any competing interests or state 'None declared': none declared

This study provides valuable data regarding the in-hospital tobacco treatment delivery, highlighting important barriers in its successful implementation. This study also reveals that even screening for smoking behavior which is identified as a priority for all patients by the WHO is not performed.

Another important finding supports a very common misperception of the healthcare professionals regarding their patients' willingness to quit and an overreporting of their performance in 5As when compared with patient data which are considered to be more reliable according to previous studies. Low rates for 5As implementation is also an alarming event for the necessity of protocols for brief councelling and pharmacotherapy treatment as a standard procedure for all smoker patients, training for all healthcare professionals especially in behavioral technics which will reduce patients' resistance and defined roles of healthcare professionals.

This manuscript is is well-written, the study is well designed and included mixed methods study with qualitative and quantitative data sources. Some minor comments are:

We are very appreciative of the positive evaluation of our manuscript and have attended to the suggestions for minor revisions below. In our response, the page numbers cited refer to the page numbers in the "clean" version of our manuscript, not the track changes version.

1) Line 28 Methods: Gives the reader the impression that patients were approached after they were discharged from the hospital while after that it is mentioned that patients were interviewed while they were hospitalized. It would be useful to clarify this

We apologize for the lack of clarity regarding our two different populations of patients, one that was recruited after a recent hospitalization (in Phase I), and the other that was recruited during their hospital stay (in Phase III). To address this issue, we have added the following clarification to Page 9: "Whereas patients in Phase I were recruited subsequent to their hospitalization as necessary for convening the group model building sessions, patients recruited in Phase III for the brief individualized interviews were still hospitalized yet nearing discharge. This facilitated accurate recall of events while minimizing the risk of missing patients who had recently been discharged or delaying patients' ability to exit the hospital once discharged."

2) Line 13 Methods: If patients from psychiatry were included this could possibly be a confounder as smoking prevalence is higher in this patient group and also perceptions of healthcare professionals are mistaken as many think that this is a high risk population and that smoking cessation could worsen the symptoms of the mental health illness so 5As and brief counselling are not very common as a practice. Please clarify this or include it in the limitation section

We appreciate this critique given the actual and perceived differences among these populations in comparison to other patient and provider groups. Fortunately, the only participants from psychiatry included 1 patient from the patient group model building sessions (all included patients were current smokers) and 1 resident psychiatrist from the resident physician group model building session. These sessions represented the exploratory phase (Phase I) of the study. No patients nor providers from psychiatry were included in Phases II or III in which we compared provider and patient reports of treatment (i.e., 5A's) offering and receipt. We have clarified this point in the limitations section on Page 20.

Reviewer: 2

Reviewer Name: Joanna Streck

Institution and Country: University of Vermont, USA

Please state any competing interests or state ‘None declared’: No conflicts

Please leave your comments for the authors below

See attached. Thank you for the opportunity to review.

This is a well-written article reporting on the results of a mixed method (quantitative and qualitative) study seeking to identify strategies to improve smoking cessation treatment offering and utilization in a midwestern hospital-an important topic to address. Enthusiasm for this manuscript would be strengthened if the below concerns were addressed, particularly comments related to the novelty of this project and how this adds to the larger literature.

We are very appreciative of the noted strengths and the constructive critiques to improve our manuscript. We have made substantial revisions to address each concern, with particular emphasis on bolstering the argument for the novelty of and need for this project in the context of the existing literature. In our response, the page numbers cited refer to the page numbers in the “clean” version of our manuscript, not the track changes version.

Major Concerns:

1. The introduction should better quantify the scope of the problem being addressed in this paper. For example, it would be helpful to reference what this study is adding to the literature and why this study is needed (in the context of the other published studies addressing smoking cessation practices among hospitalized smokers and providers which should be cited when relevant). Further, while the scope of the problem at BJH is clear, the larger scope of this project (and fit with broader literature) needs to be clarified.

We are grateful for this important critique which has provided an opportunity to clarify how this paper is positioned within, as well as how it advances and contributes to, the broader context of the literature. In the introduction (Pages 4-5), we now discuss 1) how our previous research documenting treatment gaps and disparities at BJH compares with findings from a large set of U.S. hospitals (Pack et al., 2017); 2) that this indicates suboptimal care in the context of meta-analytic support (Rigotti et al., 2012) and Joint Commission consideration of standard of care (Fiore et al., 2016); 3) that this constitutes an implementation challenge that requires pragmatic evidence from multiple stakeholder groups and further guidance on employing the best implementation strategies to improve care; and 4) how this study uniquely employs “participatory, stakeholder-engaged approaches that integrate diverse types of data to gain a better understanding of the system-level gaps in care, high-leverage target areas to focus change efforts, and specific strategies that can improve the treatment of patients who smoke.”

We further state the larger scope and contribution of our paper to the literature in the following sentence (Page 5): “This study uses a systems science lens that integrates multiple data sources to inform more systematic provision of smoking cessation treatment practices in hospital settings, thereby using a novel approach to address a thorny problem that has challenged healthcare systems for decades.”

2. Methods: “We then reconvened a select group of participants from the initial sessions..”- How was this smaller group selected? What is the rationale for taking this approach? Is it supported by the literature?

Thank you for prompting us to be clearer about this process; we have edited this sentence on Page 7. All participants in the first set of group model building sessions were invited to participate in the model review session. Reconvening stakeholders for a final session is consistent with common group model building practice in which stakeholders contribute initial structure through group model building sessions, then modelers synthesize those participant models into one synthesis model. Participants are then offered an opportunity to review and refine models that have been synthesized by the modeling team in a “model review” session. This model review functions to member check the model structure and pressure test preliminary insights. Model reviews are used to retain the coherence and participant trust of the model (Hovmand 2014), and can be used both at the end of projects and during projects to support the transition from one model representation to a new, revised model (Luna Reyes 2006). The design of the model review was based on a structured group model building “script” that is part of commonly used approaches to community-based modeling (Hovmand 2012). This script, as well as others used in the design of this workshop, can be found on the Wikibook Scriptapedia, available at https://en.wikibooks.org/wiki/Scriptapedia/.

Luna Reyes L.F. et al. Anatomy of a group model-building intervention: building dynamic theory from case study research. System Dynamics Review, 22,4.

Hovmand, P.S.; Andersen, D.F.; Rouwette, E.; Richardson, G.P.; Rux, K.; & Calhoun, A. 2012. Group model building scripts as a collaborative planning tool. Systems Research and Behavioral Science, 29.

Hovmand, Peter S., Etiënne A. J. A. Rouwette, David F. Andersen, and George. P. Richardson. 2015. Scriptapedia.

Hovmand, P.S. 2014. Community Based System Dynamics, Springer.

3. Results: It would be helpful if section headers in results more clearly described what question/prompt each of the results sections is referring to. For example, for “system insights,” it is not clear what providers and patients are responding to here and what question is being addressed with the results presented. Additionally, for “Action ideas” are these generated by the authors? Or are these ideas that patients/providers are responding to in interviews? If it is driven by the authors then this section seems more suited for discussion/conclusions.

We agree that each subsection of the group model building results (system insights, potential leverage points, action ideas) needed to be anchored by the overarching question that participants were responding to during that exercise. We have added these to Pages 11 and 12, as well as further details to add to the results beyond what is included in Table 1. We have also added a new Supplementary File, which we believe helps to clarify how the backbone structure and questions/prompts worked in tandem to initiate discussions within the group model building sessions. We also clarify on Pages 12 and 13 that providers and patients generated the action ideas to address the system insights and leverage points reported within their own group model building sessions. Therefore, the output of the “Action ideas” section was driven by participants, flowing from outputs from the system insights and potential leverage points exercises.

4. I do not see a statistical methods section but this would be helpful given that some quantitative methods were employed and I only see them addressed in the results. Missing data, if applicable, should be discussed.

Thank you for this important recommendation. We have added a “Statistical analysis approach” subsection on Page 10, adding details as well as pulling some details that were previously scattered

in the Results section and compiling them into a more appropriate location. In addition, we clarify that missing data were minimal (< 2% for the healthcare provider online survey and <3% for the patient bedside interview) and therefore handled via pairwise deletion.

5. Discussion: Similar to comment #1 above, the discussion section should highlight the novelty of this project and what this project is adding to the broader literature and clinically as well as compare current findings with what has already been published on this topic

Thank you again for prompting us to strengthen our discussion of how our study is novel and contributory to the broader literature. We now highlight at the beginning of the Discussion that "Extensive research has examined the hospital as a prime setting to engage patients in smoking cessation treatment, as well as effective treatment approaches to employ in hospital settings,(9–14) yet persistent treatment gaps signal formidable implementation challenges.(15–17)" We then go on to say that this study "uniquely employed a systems science lens to frame the implementation challenges and opportunities…" and that "Key contributions of this research include 1) detailing a participatory stakeholder-engaged process to yield hypothesis-generating qualitative data that informed the design and interpretation of quantitative data, and 2) a robust set of provider and patient levers to be activated in a multi-component implementation strategy in future research."

We also highlight findings that were somewhat different from previous research, including the following sentence: "Whereas previous research found that nearly 1 in 5 smokers admitted to a hospital smoked cigarettes during their hospital stay,(32) the rate was nearly 1 in 3 among smokers sampled in our hospital setting."

We also state that "Despite the wealth of research on inpatient smoking and hospital-based cessation treatment, far fewer studies have focused on potential collateral effects of inpatient smoking and treatment gaps, such as impeded provider workflow characterized by missed assessments and procedures, misuse of staff time, and potential safety concerns, as found in the current study."

a. Conclusions: For example, the italicized and numbered conclusions are strategies already employed and studied at various large hospitals. Do these conclusions just apply to BJH then? If not, larger implications should be discussed.

We agree that despite the system adoption at BJH that we reference to demonstrate a tangible example of local system change, the "primary contribution of these findings is in providing generalizable evidence to help other researchers, providers, and hospital administrators to prioritize the use of implementation strategies that were robustly supported across all methods and phases of our study." We recognize that the novelty of this study is not necessarily in discovering untested and unused techniques to improve treatment of patients who smoke, but instead focusing in on the key patient and provider levers that were robustly supported across all stakeholder groups and each phase of our mixed methods study.

Also in the Conclusions, we reference recent publications that add context to our highlighted strategies. For instance, Slattery et al. (2016) help to frame our interventions within the electronic health record system given the "importance of directly targeting hospital systems, including integrating key performance indicators into electronic health records, to improve the delivery of hospital smoking cessation care and the sustainability of those improvements." Further, Streck et al. (2018) help to frame our strategy to Offer positive, supportive, and non-judgmental messaging to patients given the importance of focusing on "boosting confidence and motivation to quit in patients who smoke."

Minor Concerns:

1. Introduction: "smoking prevalence remains high among those entering hospital settings." What is the comparator in this sentence? The general population? Also why is this the case? Because those with chronic conditions have higher prevalence of smoking.

We have revised the first paragraph to clarify that the comparator is the general population, as well as the primary reason for this difference in prevalence, as the reviewer has correctly pointed out.

2. Introduction: Terminology “leverage points” should be clarified

Leverage points refer to places within a complex system in which a small change can produce large changes in the overall system behavior (Meadows, 1999). In the context of system dynamics modeling, the concept of leverage point refers to specific policy interventions that activate or break feedback process, or structural changes that adjust information flows, change material flows, or adjust system goals. Text was added on Page 12 to clarify the concept of leverage points in the manuscript.

Meadows, D. 1999. Leverage Points: Places to intervene in a system. Sustainability Institute.

3. Study purpose: “determinants of treatment utilization.” The use of the word utilization suggests that the study is addressing a patient issue vs. the prior paragraph which details an issue on the provider end (offering services). Study purpose could benefit from clarification.

a. Additionally, it seems that the purpose of this study is limited to addressing cessation treatment delivery at BJH, but would be helpful to note the purpose of the study more broadly in the scope of the broader literature on this topic

We agree that “utilization” introduces unnecessary confusion about whether the problem is primarily being addressed as a patient vs. provider issues. Therefore, we have opted to rephrase this term to “treatment gap” on Page 5 to enhance consistency with the terminology used in several other places in the paper and to avoid the impression that we are focusing on this problem as a patient issue.

In addition, we have added the following sentence to the “study purpose” subsection to further highlight the purpose in a way that clearly indicates the study’s unique contribution to the broader literature: “To our knowledge, this is the only study to engage with hospital patients and providers in a participatory process to identify the underlying system structure producing the treatment gap, collateral effects of this gap (e.g., impacts on provider workflow), optimal leverage points, and actionable strategies to yield consistent delivery of smoking cessation care in hospital settings.”

4. Methods: Patients were recruited in a “diverse set of services.” Should be detailed somewhere which services these were and which were not represented and why (non response etc)

We have specified on Page 6 the “diverse set of service lines” from which we recruited providers. We also clarify that we “excluded participants from the intensive care unit, emergency room, and operating room due to lower relevance of the topic in these acute care settings” and that we “prioritized our active recruitment efforts within service lines likely to find the topic most relevant for their service delivery; therefore, some hospital services (e.g., plastic surgery, urology) fell outside the scope of our recruitment efforts.” Thus, we also clarify on Page 7 that we “received participation from each service line from which we recruited.”

5. Methods: “research participant registry.” This should be noted in the limitations section as recruitment was limited to this vs all patients

We have added a sentence to the limitations paragraph noting that “…as a pool of patients who are willing to be contacted about research studies, participants from this registry may differ somewhat from patients at-large.”

6. Methods (page 6): In the second paragraph it would be helpful to separate provider vs patient interview questions. It would also be helpful to upload the structured interview as a supplemental document.

We have added text on Pages 7-8 to clarify the ways in which the questions were framed differently for patients and providers in the semi-structured group model building exercises. We have also included a Supplementary File to clarify this structure of the group model building sessions, including how the overarching questions were framed for the different stakeholder groups.

7. Phase II: Online Survey (page 7): Unclear which are qualitative vs quantitative assessments

We have specified on Page 9 which questions within the online survey were intended to yield quantitative vs qualitative data.

8. Page 7 bolded headings: I would add in words “patient” and “providers” to further clarify and orient reader

We have added these words to the headings.

9. Page 8 “reflecting the underlying population of patients…”-What is the comparator in this sentence?

We have clarified on Page 10 that the demographics reported on in this sentence appeared to be very similar to those of the larger population of BJH patients across the hospital who were current smokers during this time frame (May 2018).

10. Page 8 “patients were asked about their smoking behaviors…”-Specific measures should be detailed here and if they stem from the literature (e.g., FTND) citations should be included. For example, one table discussed e-cigarette use in results, but I do not see mention of data collection instruments for e-cigarette use in this methods section.

Thank you for this recommendation to add detail on the instruments we used. We have added detail on Page 10 to further specify these data collection instruments and referenced the questionnaire from a published article (Chen et al., 2017) which compared patient and provider reports in a different context and formed the basis of our structured interview in this study.

11. Page 8, “Patient and public involvement” section- This section header is confusing and seems a bit misaligned with the content of this section. It seems this section is discussing the ways in which qualitative work informed quantitative work?

We understand this critique regarding this section header, content, and placement. The reason it is included and placed here is because the journal BMJ Open requests that authors “provide a Patient and Public Involvement statement in the Methods section of their papers, under the subheading ‘Patient and public involvement’.” BMJ Open lists several questions that are to be addressed in this section, which dictated the content we included in this section: https://bmjopen.bmj.com/pages/authors/. To remain compliant with journal instructions, we have retained this section; however, with guidance from the editor, we would be happy to adjust the content and/or placement of this section, as appropriate.

12. Page 9 “we plan to disseminate results of this study to patients…”-How is this different than any other study that is published and presented at a conference? This section seems unconventional and not sure what it is adding.

Please see the above response to critique #11; we understand that the content and placement of this section seems unconventional, but have left it here to remain compliant with journal guidelines. The statement regarding our dissemination plans stems from the journal instructions to address the question of “How were (or will) [patients] be involved in your plans to disseminate the study results to participants and relevant wider patient communities (e.g. by choosing what information/results to share, when, and in what format)?” under the ‘Patient and public involvement’ subheading in the

Methods section. Again, with guidance from the editor, we would be happy to adjust the content and/or placement of this section, as appropriate.

Appreciate the opportunity to review this manuscript.