Citing this paper
Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

General rights
Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the Research Portal

Take down policy
If you believe that this document breaches copyright please contact librarypure@kcl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.
SOFTWARE METAPAPER

InDEx: Open Source iOS and Android Software for Self-Reporting and Monitoring of Alcohol Consumption

Daniel Leightley¹, Jo-Anne Puddephatt², Laura Goodwin², Roberto Rona¹ and Nicola T. Fear¹,³

¹ King’s Centre for Military Health Research, Institute of Psychiatry, Psychology and Neuroscience, King’s College London, GB
² Department of Psychological Sciences, University of Liverpool, GB
³ Academic Department of Military Mental Health, Institute of Psychiatry, Psychology and Neuroscience, King’s College London, GB

Corresponding author: Dr. Daniel Leightley (daniel.leightley@kcl.ac.uk)

InDEx is a software package for reporting and monitoring alcohol consumption via a smartphone application. Consumption of alcohol is self-reported by the user, and the app provides a visual representation of drinking behaviour and offers feedback on consumption levels compared to the general population. InDEx is intended as an exemplar app, operating as a standalone smartphone application and is highly customisable for a variety of research domains. InDEx is written in JavaScript, using IONIC framework which is cross-platform and is available under the liberal GNU General Public License (v3). The software is available from GitHub (https://github.com/DrDanL/index-app-public).

Keywords: alcohol; monitoring; smartphone; iOS; Android; IONIC

Funding statement: This study was funded by the Medical Research Council (MR/N028244/2).

(1) Overview

Introduction
Self-reported alcohol misuse is high amongst personnel of the United Kingdom (UK) Armed Forces, with the trend continuing after they leave service [1, 5]. More than 50% of those who have left military service meet the criteria for hazardous alcohol use, defined as scoring 8 or more on the Alcohol Use Disorders Identification Test [2, 3]. This prevalence rate is almost double that found in the general population [4]. Most people in the general population underestimate their drinking and do not perceive it as problematic, even when the level of consumption is potentially harmful to health [6]. This pattern is similar among Armed Forces personnel, with less than half of harmful drinkers recognising that they have an alcohol problem [7]. There is a culture of heavy alcohol use in the AF which may be encouraged or maintained by social determinants [8]; therefore, leaving service could provide an opportunity to initiate change in settings with less peer pressure to conform to social norms.

One medium in changing alcohol consumption is using a smartphone application (app). Existing alcohol apps emphasise longer-term health consequences which are seen as remote risks by young drinkers [9–11], however, a recent meta-analysis suggests that there may be greater benefits to focusing on shorter term consequences in order to encourage individuals to reduce their alcohol consumption [12, 13]. To the authors’ knowledge, we are unaware of any academic studies in this field which have released the source code under Open Source Initiative approved licenses to encourage reuse [14]. Information about Drinking for Ex-serving personnel (InDEx) was developed as an app to enable the self-reporting and monitoring of alcohol consumption in veterans who reside within the UK over a period of 28 days. See Figure 1 for screenshot examples of the InDEx app on a mobile device. InDEx was based on the following requirements:

- The app should be compatible across modern (released after 2012) Android (Google Inc, Mountain View, California, United States) and iOS (Apple Inc, Cupertino, California, United States) operating systems.
- The app should be capable of storing data locally and make it retrievable as required by the app.
- The app should allow users to self-report and record a range of alcoholic drinks (including quantity, who with and where) and offer the ability of recording a ‘Drink Free Day’.
- The app should be able to collect a range of self-reported measures obtained via in-app questionnaires.
- The system should provide a simple registration and signup process with minimal data collection.

The objective of this paper is to describe the development of the app. It will provide the research community with an
exemplar app for use in other studies, and highlight the key stages to development.

**Implementation and architecture**
InDEx was developed between October 2016 and March 2017 using JavaScript (ES6), HTML (5) and CSS (3).

**Development life-cycle**
InDEx used Agile development methodologies [15], with each cycle focusing firstly on the development and secondly on stakeholder/expert user testing (as illustrated in Figure 2). An incremental approach was employed, where each cycle built upon the functionality of the previous with new functionality introduced based on stakeholder/export user feedback. The cycle would not progress until stakeholder feedback on core features had been addressed.

**Core Features**
**Screening and Normative Feedback:** This module consists of two elements. First, at specific periods during the app life-cycle (e.g. day 0, 7, 14, 21 and 28) users are...
presented with a set of questionnaires (defined by the research team) and responses are logged (screening.js [state: screening]). Secondly, questionnaire responses are analysed to produce an informative visual feedback on alcohol consumption (normative.js [state: normative]).

**Alcohol Reporting and Monitoring:** This module consists of two elements. First, users are able to log alcohol consumption and ‘Drink Free Days’ (addDrink.js [state: adddrink]). Optional consent is available to obtain GPS location (geolocation.factory.js). Further, users can optionally record information on who they are with and where they are drinking. Second, a range of metrics are generated to provide an overview of current consumption (normative.controller.js [state: tabs/normative]).

**Goals:** This module enables users to set goal(s) based on implementation intentions [16]; a methodology that empowers the user to form self-regulation strategies in the form of an if-then plan. Users can select a goal (goals.js [state: tabs/goals]) and identify what is the biggest barrier to achieving that goal. Table 1 illustrates goal setting with if-then. Visual feedback is provided to users on progress towards achieving goal(s) and a status on those that have expired.

**Account Management:** This module (account.js [state: tabs/account]) enables users to modify and review personal information (e.g. first name, last name, mobile number), password and app parameters (e.g. automatic log out).

**InDEx Implementation**
The software is implemented using Drifty Co (Madison, Wisconsin, United States) IONIC Framework version 1, which is a cross-platform framework for web and mobile apps. The software has been implemented as a standalone application and does not require connection to a central service.

**Quality control**
All functions have been individually tested for correctness to ensure their correct behaviour. Furthermore, all versions of the software underwent rigorous testing by stakeholder/expert users sourced from King’s Centre for Military Health Research and University of Liverpool (n = 17) to ensure software quality and usability.

(2) **Availability**

**Operating system**
- **Development:** Windows 7 or above. Mac OS X El Capitan or above.
- **Production:** Compatible on iOS and Android operating systems released after 2012.

**Programming language**
InDEx is written in JavaScript (ES6), HTML5 and CSS3.

**Additional system requirements**
None beyond requirements of the operating system and dependencies (listed hereafter).

**Dependencies**
IONIC Framework version 1 (tested v3.0.0) [17]. All other dependencies are stated within the source code and accessed via a Content Delivery Network (CDN).

**List of contributors**
This list of authors includes all main contributors. Daniel Leightley led the software development and is its current maintainer.

**Software location**

**Archive**
- **Name:** Zenodo
- **Persistent identifier:** https://doi.org/10.5281/zenodo.1068121
- **Licence:** GNU General Public License (v3)
- **Publisher:** Daniel Leightley
- **Version published:** 1.0.0
- **Date published:** 29/11/2017

**Code repository**
GitHub
- **Name:** index-app-public
- **Identifier:** https://github.com/DrDanL/index-app-public
- **Licence:** GNU General Public License (v3)
- **Date published:** 29/11/2017

**Language**
English (UK)

(3) **Reuse potential**
InDEx (v1.0.0) enables research rapid access and reuse to an exemplar smartphone app for use in alcohol research, but provides the facility to modify the software for uses in other domains. The software has been made freely available to the community to further develop, extend and contribute to the app ecosystem. The GNU General Public License (v3) has been selected to ensure that developments are shared with the community, to the benefit of the community.

Support for modifying and using the software is available through GitHub issues page (https://github.
Acknowledgements
The authors would like to thank Zoe Chui, Matt Field, Colin Drummond, Toktam Mahmoodi, Norman Jones and Margaret Jones for their contributions to the inception and overall progress of this project.

Competing Interests
The authors have no competing interests to declare.

References

1. Rona, R J, Fear, N T, Hull, L, Greenberg, N, Earnshaw, M, Hotopf, M and Wessely, S 2007 “Mental health consequences of overstretch in the UK armed forces: First phase of a cohort study.” Br. Med. J., 335: 603–610. DOI: https://doi.org/10.1136/bmj.39274.585752.8E

2. Saunders, J B, Assland, O G, Babor, T F and De La Fuente, J R 1993 “Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption-I.” J. Addiction, 88(6): 791–804. DOI: https://doi.org/10.1111/j.1360-0443.1993.tb02093.x

3. World Health Organisation 2015 “Global status report on alcohol and health 2014.”

4. McManus, S, Bebbington, P, Jenkins, R and Brugha, T 2014 “Mental Health and Wellbeing in England: Adult Psychiatric Morbidity Survey 2014.” Leeds.

5. Rona, R J, Jones, M, Fear, N T, Hull, L, Hotopf, M and Wessely, S 2010 “Alcohol misuse and functional impairment in the UK Armed Forces: A population-based study.” Drug Alcohol Depend., 108(1–2): 37–42. Apr. 2010. DOI: https://doi.org/10.1016/j.drugalcdep.2009.11.014

6. Garnett, C, Crane, D, West, R, Mitchie, S, Brown, J and Winstock, A 2015 “Normative misperceptions about alcohol use in the general population of drinkers: A cross-sectional survey.” Addict. Behav., 42: 203–206. Mar. 2015. DOI: https://doi.org/10.1016/j.addbeh.2014.11.010

7. Hines, L A, Goodwin, L, Jones, M, Hull, L, Wessely, S, Fear, N T and Rona, R J 2014 “Factors affecting help seeking for mental health problems after deployment to Iraq and Afghanistan.” Psychiatr. Serv., 65(1): 98–105. Jan. 2014. DOI: https://doi.org/10.1176/appi.ps004972012

8. Jones, E and Fear, N T 2011 “Alcohol use and misuse within the military: A review.” Int. Rev. Psychiatry, 23(2): 166–172. DOI: https://doi.org/10.3109/0954261.2010.550868

9. Garnett, C, Crane, D, Mitchie, S, West, R and Brown, J 2016 “Evaluating the effectiveness of a smartphone app to reduce excessive alcohol consumption: protocol for a factorial randomised control trial.” BMC Public Health, 16(536). DOI: https://doi.org/10.1186/s12889-016-3140-8

10. Attwood, S, Parke, H, Larsen, J and Morton, K L 2017 “Using a mobile health application to reduce alcohol consumption: a mixed-methods evaluation of the drinkaware track & calculate units application.” BMC Public Health, 17(394). DOI: https://doi.org/10.1186/s12889-017-4358-9

11. Weaver, E R, Horyniak, D R, BiomedSci, B, Jenkinson, R, Dietze, P and Lim, M S C 2013 “‘Let’s get Wasted!’ and Other Apps: Characteristics, Acceptability, and Use of Alcohol-Related Smartphone Applications.” JMIR MHealth UHealth, 1(1): e9.

12. Connor, J P, George, S M, Gullo, M J, Kelly, A B and Young, R M 2011 “‘A Prospective Study of Alcohol Expectancies and Self-Efficacy as Predictors of Young Adolescent Alcohol Misuse.’ Alcohol Alcohol., 46(2): 161–169. DOI: https://doi.org/10.1093/alcalc/agr004

13. Donohue, K, Patton, R, Phillips, T, Deluca, P and Drummond, C 2014 “The Effectiveness of Electronic Screening and Brief Intervention for Reducing Levels of Alcohol Consumption: A Systematic Review and Meta-Analysis.” J. Internet Med. Res., 16(6): e142. DOI: https://doi.org/10.2196/jmir.3193

14. Initiative, O, Open, T and Definition, S 2004 “Open source initiative.” At http://www.opensource.org/index.html Accessed [Online]. Available: https://opensource.org/ [Accessed: 08-Nov-2017].

15. Clinton, K 2008 “An agile Retrospective.” [Online]. Available: http://www.clintonkeith.com/resources/GDC2008-AnAgileRetrospective.pdf [Accessed: 06-Nov-2017].

16. Gollwitzer, P M and Sheeran, P 2006 “Implementation Intentions and Goal Achievement: A Meta-analysis of Effects and Processes.” Advances in Experimental Social Psychology, 38: 69–119. Academic Press. 01-Jan-2006.

17. Drifty Co 2013 “Ionic Framework.” [Online]. Available: http://ionicframework.com/ [Accessed: 10-Nov-2017].

How to cite this article: Leightley, D, Puddephatt, J-A, Goodwin, L, Rona, R and Fear, N T 2018 InDEx: Open Source iOS and Android Software for Self-Reporting and Monitoring of Alcohol Consumption. Journal of Open Research Software, 6: 13. DOI: https://doi.org/10.5334/jors.207

Submitted: 29 November 2017 Accepted: 05 March 2018 Published: 23 March 2018

Copyright: © 2018 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See http://creativecommons.org/licenses/by/4.0/.

Journal of Open Research Software is a peer-reviewed open access journal published by Ubiquity Press.

OPEN ACCESS