Citation for published version (APA):
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).
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

---

**Figure 1:** Example screenshots captured from the InDEx app.

**Figure 2:** The Agile development methodology employed during development of the InDEx app.
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