

Saving lives with

REASONML

DOUGLAS TEOH

dteoh.com

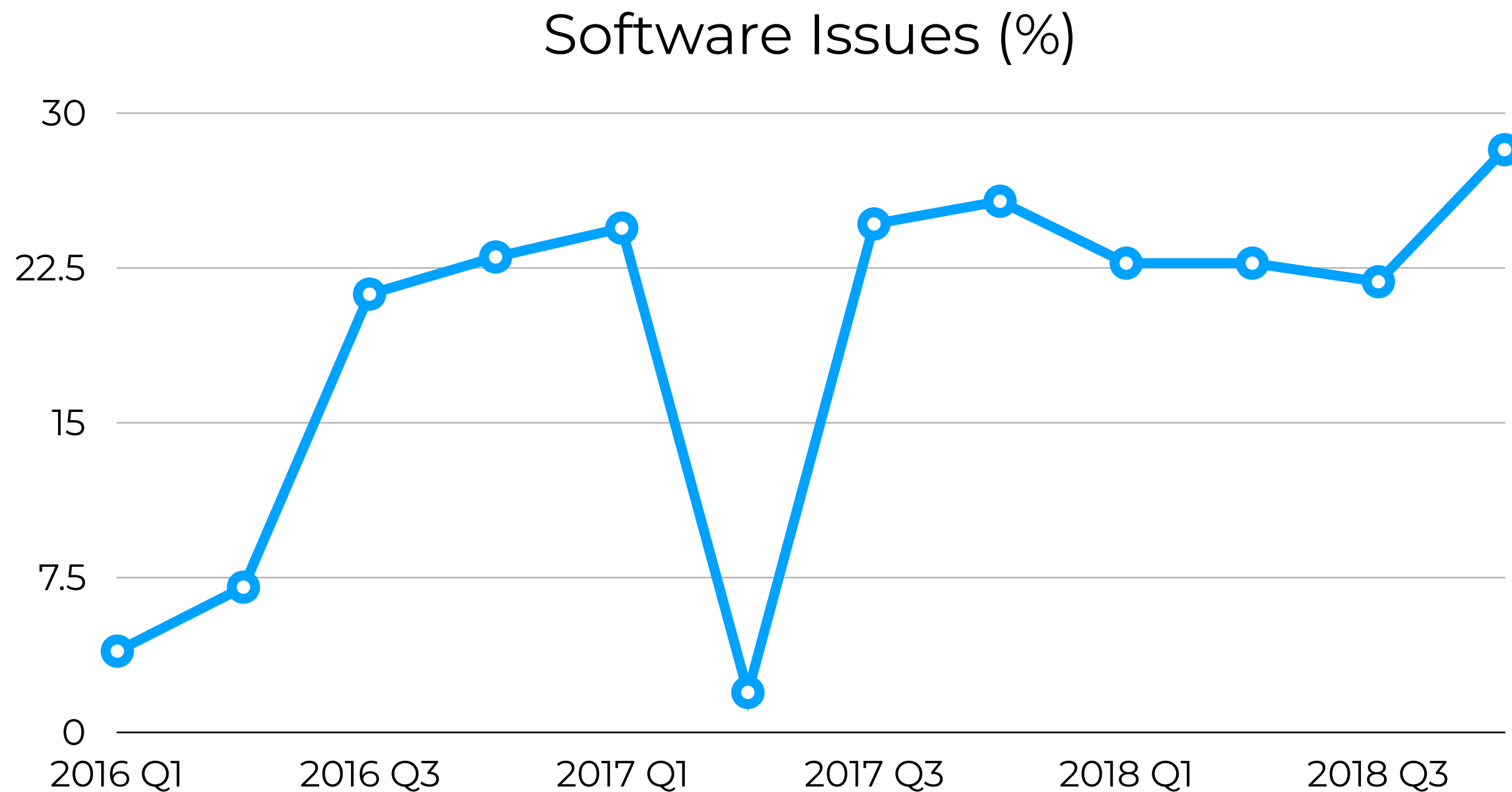
dteoh #3808

allm.net/en



SHAPING
HEALTHCARE

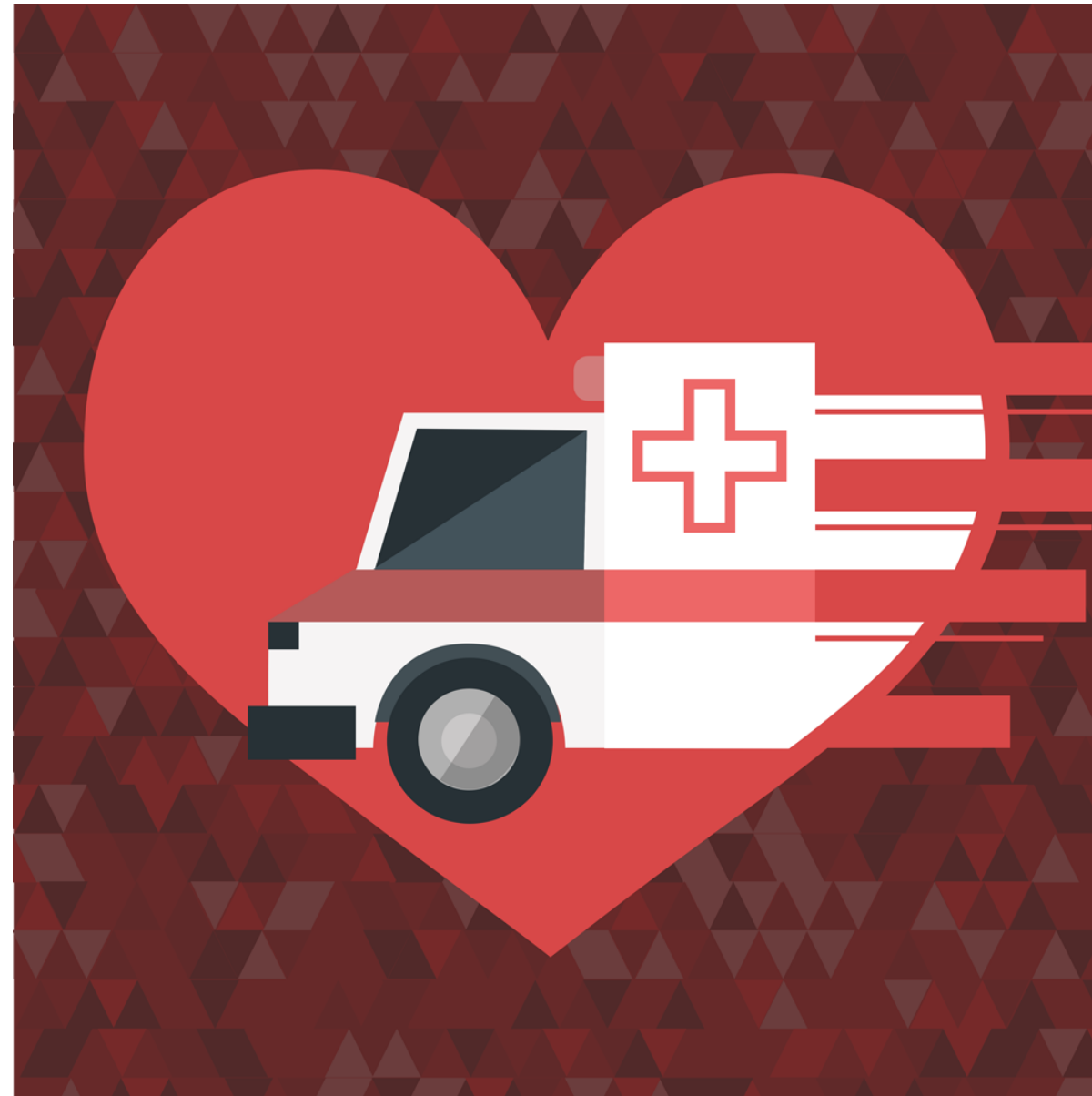
Medical Device Recalls



Sourced from Stericycle Expert Solutions Recall Index



Therac-25



Fast-ED

Android + iOS app



Stroke

- Ischemic and Hemorrhagic
- No oxygen → brain cells die, loss of brain function

Why an app?

- One of the leading causes of death
- Symptoms observable
- Survival correlated with time to treatment

Assessing a stroke?

docomo

VPN

8:43 pm

74%

Back

Dizziness

Is the patient dizzy, retching, or vomiting?

Yes

✓

No

docomo

VPN

8:49 pm

73%

< Pain

Irradiation pain

Is the patient experiencing pain somewhere else?
(radiating pain)

Select body parts where patient has pain.

Chin

✓

Epigastric fossa

Shoulder or arm

✓

Back

Next

docomo

VPN

8:50 pm

73%

< Heart rate

Blood pressure

Blood pressures

Value of systolic blood pressure in left arm can be input later.

Right arm systolic blood pressure

203

(0-300)

Right arm diastolic blood pressure

184

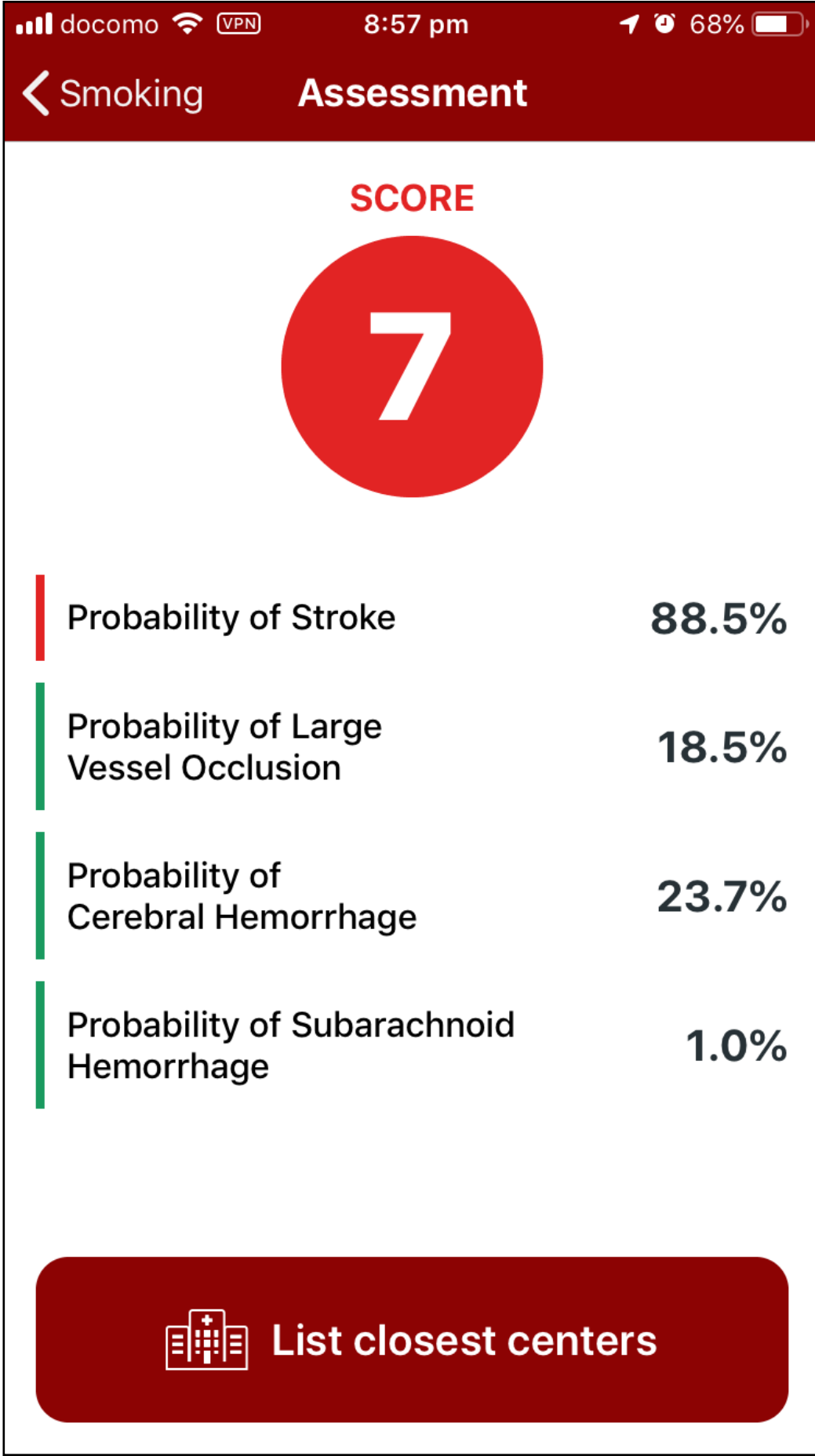
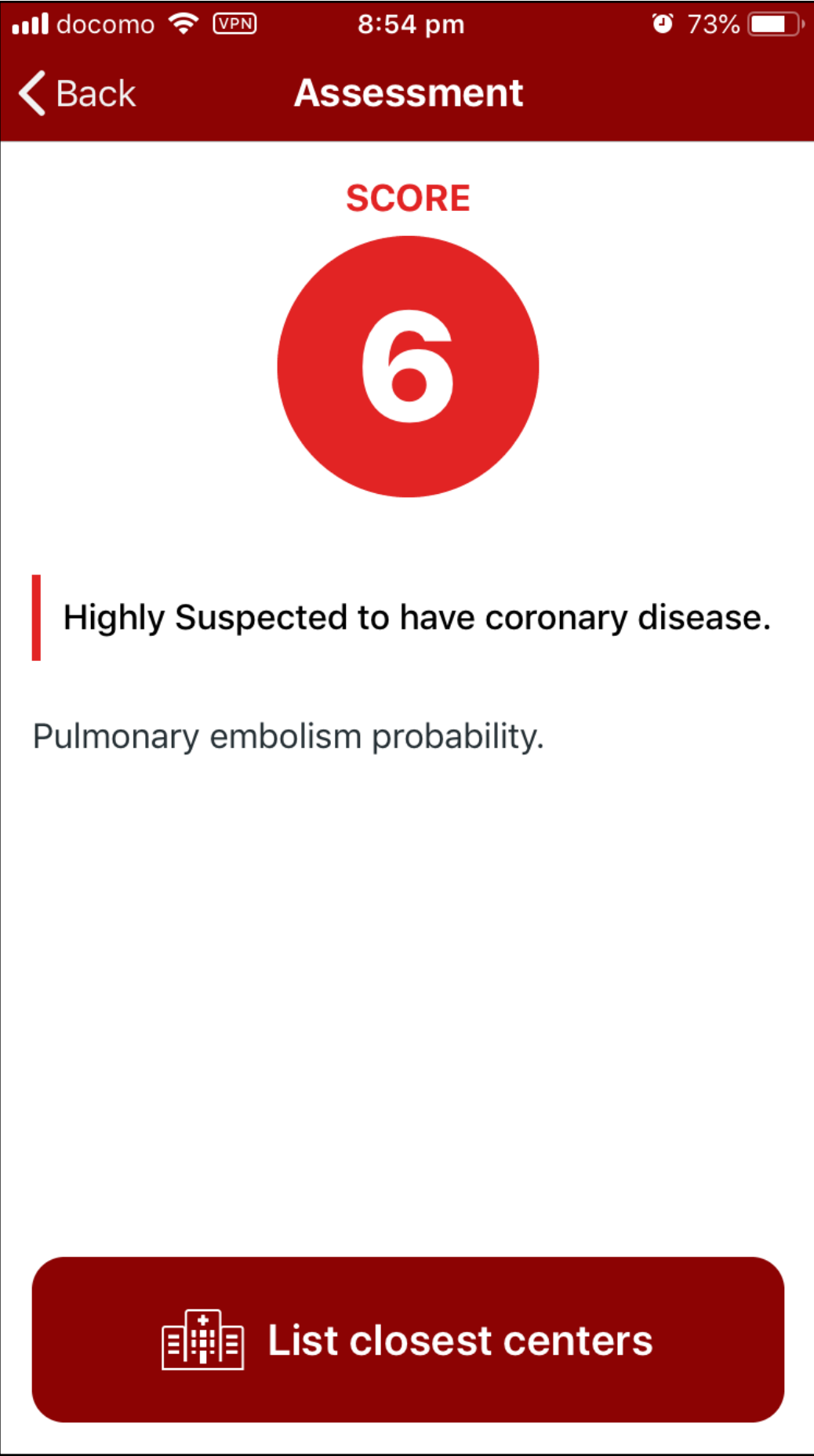
(0-200)

Left arm systolic blood pressure

mmHg

(0-300)

Next



docomo

VPN

8:56 pm

72%

Back

Medical Centers

Finish



順天堂大学医学部附属順天堂
医院

日本, 〒113-8431 東京都文京区本郷3丁目1-3

15 mins | 4.1 km

CCU

EC

EMT

TPA





東京医科歯科大学医学部附属
病院

日本, 〒113-8519 東京都文京区湯島1丁目5-4 5

16 mins | 4.5 km

CCU

EC

EMT

TPA



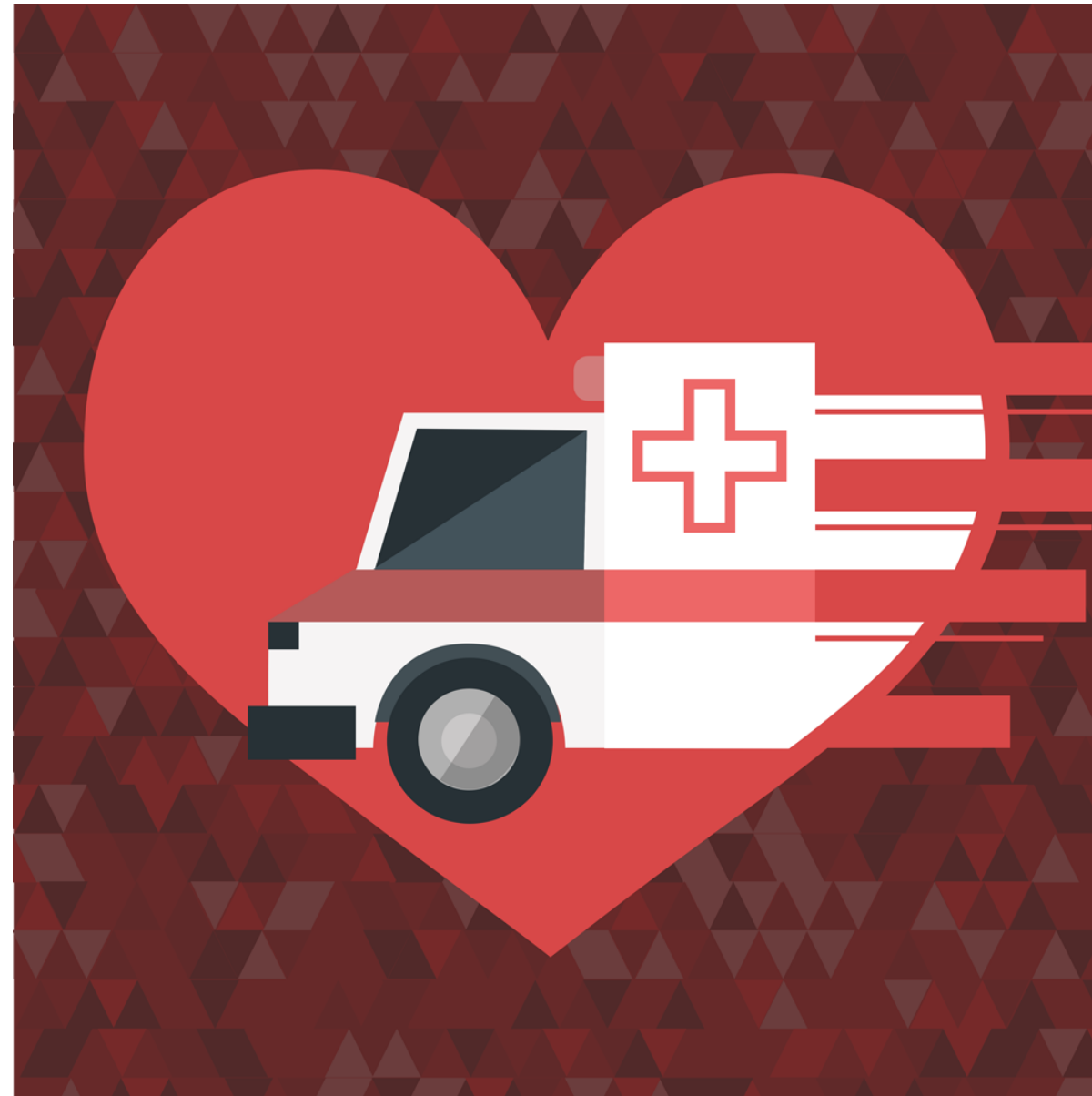


東京都済生会中央病院

日本, 〒100-0072 東京都港区三田1丁目







Fast-ED

Android + iOS app

JAVASCRIPT?
IN MEDICAL APPS?

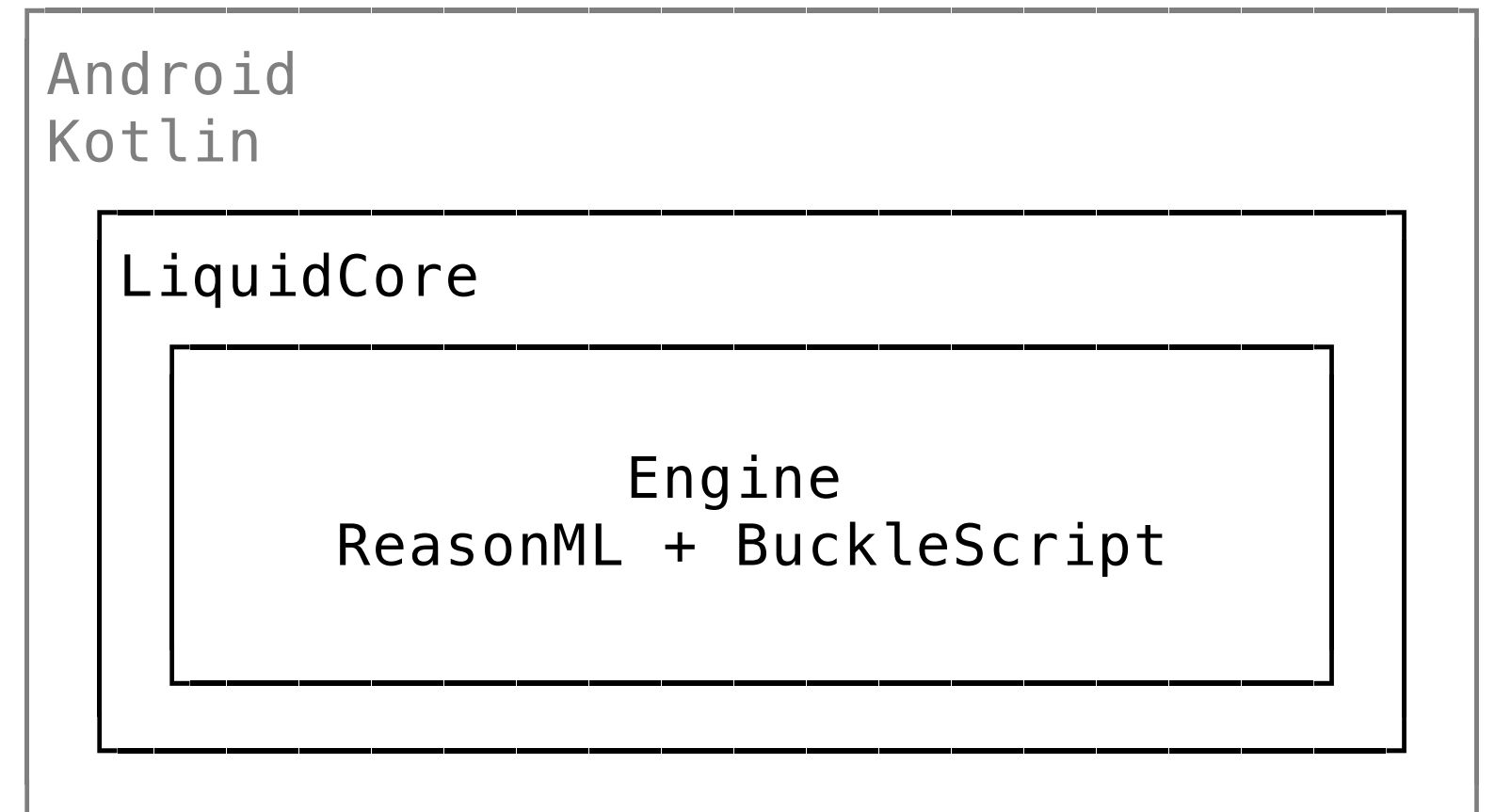
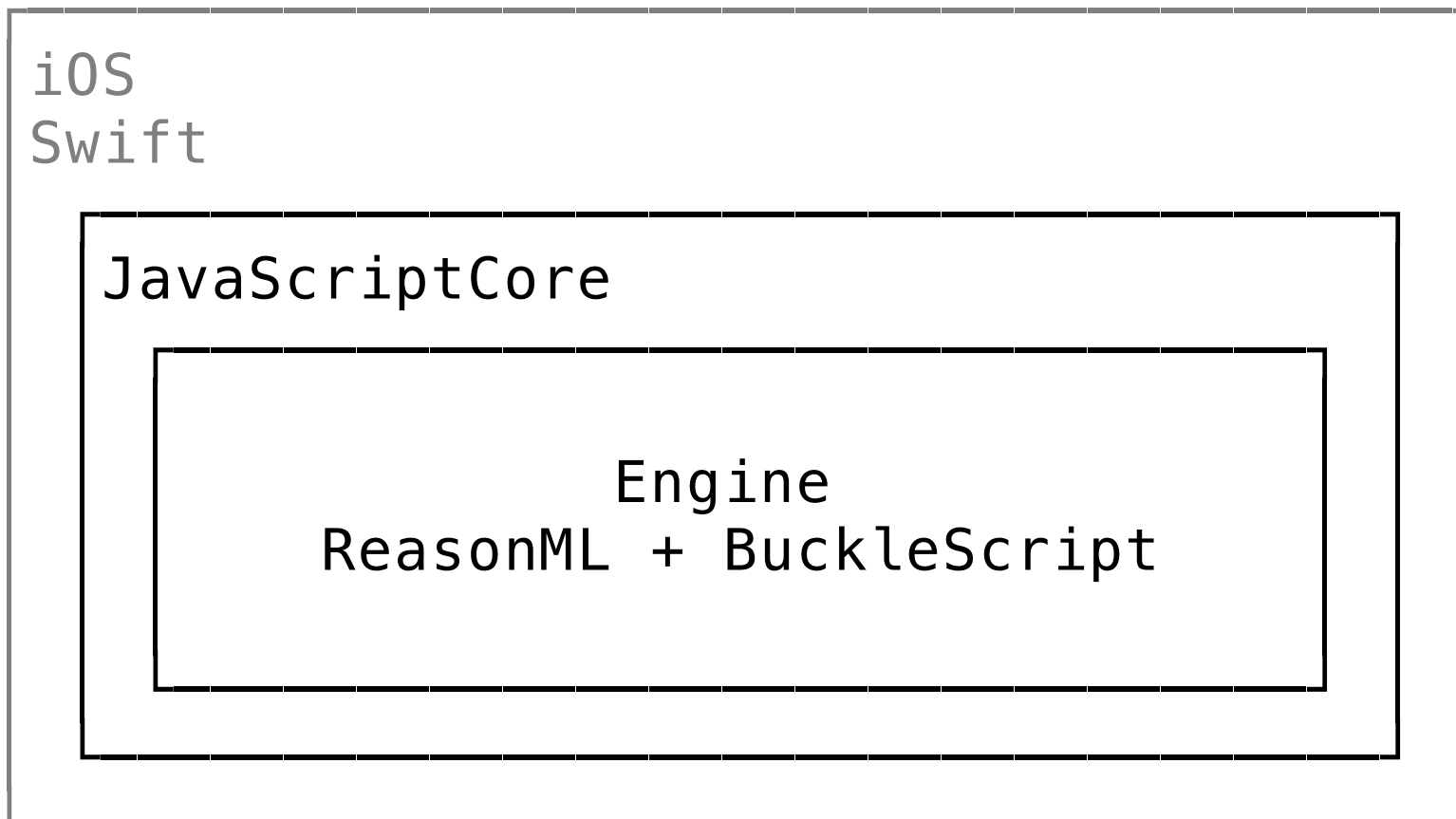
APP STRUCTURE

iOS
Swift

Android
Kotlin

GraphQL API
Ruby





Mobile App

ES6 Environment

- * parsing a scale
- * what to render
- * stroke assessment
- * hospital recommendations

Engine API

Swift/Kotlin



Mobile App

ES6 Environment

- * parsing a scale
- * what to render
- * stroke assessment
- * hospital recommendations

Engine API

Swift/Kotlin

- * UI rendering
- * GraphQL API calls
- * Maps
- * Geolocation

VARIANTS

option('a')

MODELLING

API DATA

```
{
  "questions": [
    {
      "id": "...",
      "type": "text",
      "title": "Asomatognosia",
      "tip": null,
      "choices": [
        {
          "id": "...",
          "display": "button",
          "label": "Normal",
          "description": "Patient recognizes his/her weak arm.",
          "upper_bound": null,
          "lower_bound": null,
          "many_other_optional_attrs": null
        },
        "..."
      ]
    },
    "..."
  ]
}
```

```
type choice = {  
    id: string,  
    display: string,  
    label: string,  
    description: string,  
    upperBound: option(float),  
    lowerBound: option(float),  
    manyOtherOptionalAttrs: option(string),  
};
```

```
type button = {  
    id: string,  
    label: string,  
    description: string,  
};
```

```
type range = {  
    id: string,  
    label: string,  
    description: string,  
    upperBound: float,  
    lowerBound: float,  
};
```



```
type choice =  
  | Button(button)  
  | Range(range);
```

FINDING DOMAIN ERRORS



```
let nextQuestion:  
  (Question.t, Responses.t)  
=> option(Question.t);
```

```
let evalQuestion:  
  (Question.t, Responses.t)  
=> option(int);
```

```
switch (result) {  
| Some(question) => /* show next question */  
| None => a; /* not answered OR ... */  
| None => b; /* scale finished? */  
};
```

```
type status( 'a ) =  
  | Answered( 'a )  
  | Unanswered;
```

```
type next =  
  | Terminal  
  | Static( Question.t );
```

```
let nextQuestion:  
  ( Question.t, Responses.t )  
=> status( next );
```

**Be careful when
using option('a)**

DISAMBIGUATING COMMONLY USED TYPES

```
module type OpaqueID = {  
  type t;  
  let make: string => t;  
  let cmp: (t, t) => int;  
};  
  
module OpaqueStringID: OpaqueID = {  
  type t = string;  
  let make = str => str;  
  let stringOf: t => string = opq => opq;  
  let cmp = (o1, o2) => compare(stringOf(o1), stringOf(o2));  
};  
  
module QuestionID: OpaqueId = { include OpaqueStringID; };  
module ChoiceID: OpaqueId = { include OpaqueStringID; };
```


REVEALING

SYSTEM ERRORS

Belt's

Result.t('a, 'error)

Result.t('a, **string**)

```
module ErrorResult = {  
    type t =  
        | BooleanExpected(ChoiceID.t)  
        | DateTimeExpected(ChoiceID.t)  
        | AssessmentsNotImplemented(ScaleID.t)  
        | Etc;  
};
```

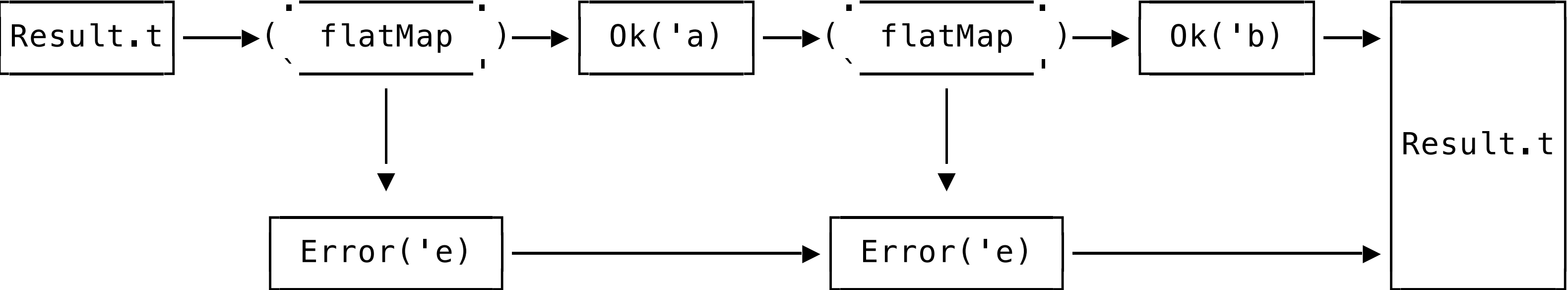
```
Belt.Result.t('a, ErrorResult.t);
```

Result.t('a, 'error)

```
Belt.Result.flatMap( computationA, a => {
    Belt.Result.flatMap( computationB, b => {
        Belt.Result.flatMap( computationC, c => {
            Belt.Result.flatMap( computationD, d => {
                Belt.Result.map( computationZ, z => {
                    fn( a, b, c, d, z );
                });
            });
        });
    });
});
```

```
let flatMap4: (  
    Belt.Result.t('a, 'err),  
    Belt.Result.t('b, 'err),  
    Belt.Result.t('c, 'err),  
    Belt.Result.t('d, 'err),  
    ('a, 'b, 'c, 'd) => Belt.Result('e, 'err)  
) => Belt.Result('e, 'err);
```

Railway Oriented Programming



INTEROP

**Exchange JSON
compatible
structures**

docomo

VPN

8:50 pm

73%

< Heart rate

Blood pressure

Blood pressures

Value of systolic blood pressure in left arm can be input later.

Right arm systolic blood pressure

203

(0-300)

Right arm diastolic blood pressure

184

(0-200)

Left arm systolic blood pressure

mmHg

(0-300)

Next

```
[
  {
    id: "right_arm_systolic",
    input: 203
  },
  {
    id: "right_arm_diastolic",
    input: 184
  },
  {
    id: "left_arm_systolic",
    input: null
  },
  {
    id: "next",
    input: true
  }
]
```

Use Js.Json.t

+

Js.Json.classify

docomo

VPN

8:54 pm

73%

Back

Assessment

SCORE

6

Highly Suspected to have coronary disease.

Pulmonary embolism probability.

List closest centers

docomo

VPN

8:56 pm

72%

Back

Medical Centers

Finish

順天堂大学医学部附属順天堂医院

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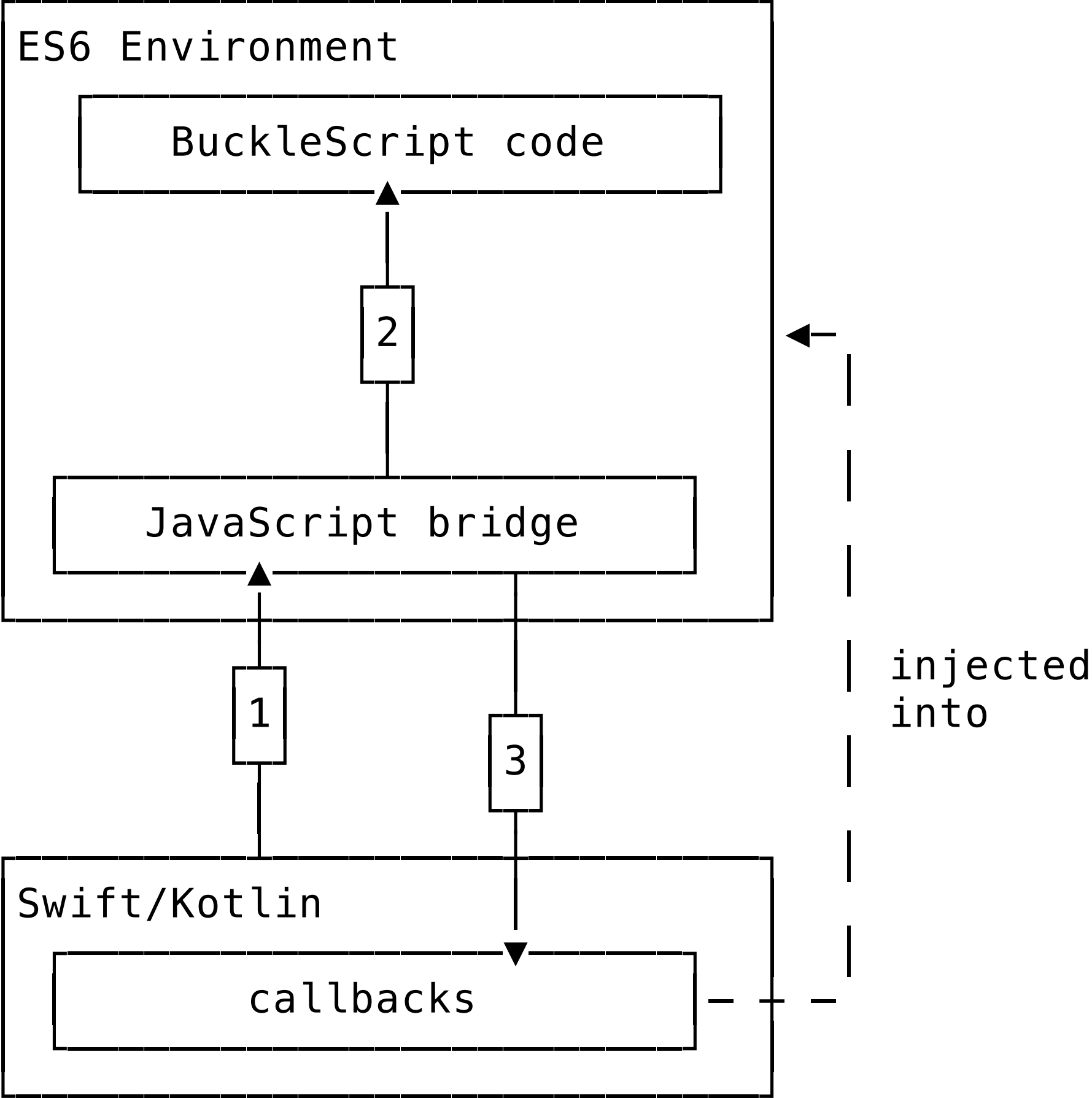
TPA

東京都済生会中央病院

日本, 〒100-0072 東京都港区三田1丁目

JS objects

- `[@bs.deriving “abstract”]` for inputs
- `bs-json` library to output `Js.Json.t`



TESTING

with **bs-jest**



PACKAGING

with **Parcel**

parceljs.org

Saving lives with

REASONML

DOUGLAS TEOH

dteoh.com

dteoh #3808

allm.net/en



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HEALTHCARE