

## Feasibility of digital contact tracing in low-income settings – pilot trial for a location-based DCT app

Journal: BMC Public Health

Eric Handmann, MD (first author, corresponding author)

Department for Emergency Medicine, University Hospital Leipzig, Leipzig, Germany

Mail: Eric.Handmann@medizin.uni-leipzig.de; ORCID #0000-0001-7584-007X

Sia Wata Camanor, Mosoka P. Fallah, Neima Candy, Davidetta Parker, André Gries, Thomas Grünewald

**AF 1** This document contains the java script based software code to analyze contacts between participants

```
// C4:93:D9:27:18:71
//SELECT Cases_Region,Cases_Data FROM `Cases` WHERE DATE(Cases_Date) >=
'2020-02-01' AND length(Cases_Data) > 2 GROUP BY Cases_Region ORDER BY
Cases_Region;

var selector1 = document.getElementById('select_case1');
var selector2 = document.getElementById('select_case2');
var inputRange = document.getElementById('inputRange');
var inputTime = document.getElementById('inputTime');
var submitButton = document.getElementById('submit_button');
var output = document.getElementById('output');
var selectedCase1 = {};
var selectedCase2 = {};
var cleanedCases = cleanCases();
var mergedDuplicates = mergeDuplicates();
//printAll();
var finalCases = removeDuplicateTimestamps ();
buildDropDown();
var foundCounter = 0;
var maxRange = 5;
var minTimePref = 2*60*1000;

selector1.addEventListener("change", function(){
    var i = selector1.options[selector1.selectedIndex].value;
    selectedCase1 = mergedDuplicates[i];
})

selector2.addEventListener("change", function(){
    var i = selector2.options[selector2.selectedIndex].value;
    selectedCase2 = mergedDuplicates[i];
})

inputRange.addEventListener("change", function(){
    maxRange = parseInt(inputRange.value)
})

inputTime.addEventListener("change", function(){
    minTimePref = parseInt(inputTime.value)
    minTimePref = minTimePref*60*1000;
})

submitButton.addEventListener("click", iterateCases);

function buildDropDown() {
    mergedDuplicates.forEach(function(obj, i){
        var option = document.createElement("option");
        option.text = obj.id+" (" +obj.data.length+" )";
```

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```
        option.value = i;
        selector1.appendChild(option);
        selector2.appendChild(option.cloneNode(true));
    })

}

function cleanCases() {
    var cleanedCases = [];
    cases.forEach(function(e,i) {
        var obj = {};
        obj.id = e.Cases_Region;
        var tmpData = JSON.parse(e.Cases_Data);
        var resData = [];
        tmpData.forEach(function(ee) {
            var innerObj = {};
            innerObj.timestamp = ee[ee.length-1];
            innerObj.lat = ee[0];
            innerObj.lng = ee[1];
            innerObj.bt = ee[3];
            resData.push(innerObj);
        })
        obj.data= resData;
        cleanedCases.push(obj);
    });
    return cleanedCases;
};

function printAll() {
    cleanedCases.forEach(function(cs) {
        cs.data.forEach(function(d) {
            var myDate= new Date(d.timestamp);
            var dateString = myDate.getDate();
            if(dateString <=9) dateString = '0'+dateString;
            var hourString = myDate.getHours();
            if(hourString <=9) hourString = '0'+hourString;
            var minuteString = myDate.getMinutes();
            if(minuteString <=9) minuteString = '0'+minuteString;
            if(d.bt.length > 3)
            {
                bts = JSON.parse(d.bt);
                bts.forEach(function(bt) {
                    var p = ''
                    p = cs.id+";"+d.timestamp+";"+myDate.getFullYear()+"-
0"+(myDate.getMonth()+1)+"-
"+dateString+";"+hourString+":"+minuteString+";"+d.lat+";"+d.lng+";"+bt+"
\\n";
                    output.append(p);
                })
            }
            else {
                var p = '';
            }
        })
    })
}
```

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```
        p = cs.id+";"+"d.timestamp"+";"+"myDate.getFullYear()+"-
0"+(myDate.getMonth()+1)+"-
"+"dateString"+";"+"hourString"+";"+"minuteString"+";"+"d.lat"+";"+"d.lng"+";"+"d.bt
+"\\n";
```

```
        output.append(p);
    }

    })

})

}

function mergeIterator(current, previous) {
    var mergedResultData = [];
    previous.data.forEach(function(e) {
        var found = false;
        tmp = e;
        var tmp2 = {}
        current.data.forEach(function(ee) {
            tmp2 = ee;
            if(ee.timestamp == e.timestamp) {
                found = true;
            }
        })
        if(!found)
            mergedResultData.push(tmp2);
        mergedResultData.push(e);
    })
    return mergedResultData;
}
```

```
function mergeDuplicates() {
    var result = [];
    var previousCase = cleanedCases[0];
    cleanedCases.forEach(function(e, i) {
        if(i==0) {
            result.push(e);
        }
        else {
            if(e.id == previousCase.id) {
                e.data = mergeIterator(e, previousCase);
            }
            else result.push(e);
            previousCase = e;
        }
    });
    return result;
};
```

```
function removeDuplicateTimestamps() {
    mergedDuplicates.forEach(function(e) {
        previousTimestamp = 0;
    });
}
```

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```
    tmpData = [];
    e.data.forEach(function(ee) {
        if(ee.timestamp != previousTimestamp)
            tmpData.push(ee)
        previousTimestamp = ee.timestamp;
    })
    e.data = tmpData;
})
return mergedDuplicates;
}
function iterateCases() {
    output.innerHTML = "";
    var foundMatches = [];
    finalCases.forEach(function(e) {
        selectedCase2 = e;
        //console.log(e.id);
        if(selectedCase1.id != selectedCase2.id) {
            var c = evaluateCase();
            if(c.timestamps.length > 0)
                foundMatches.push(c);
        }
    })
    // now we have the timestamps for matches. Calculate time together

    foundMatches.forEach(function(e) {
        timeSum = 0;
        e.timestamps = e.timestamps.sort();
        var previous = e.timestamps[0];
        var contactDates = [];
        var contactDuration = 0;
        var contactDurations = [];
        contactDates.push(new Date(previous));
        e.timestamps.forEach(function(ee) {
            if(ee-previous < 900000 && previous != 0) {
                timeSum += ee-previous;
                contactDuration += ee-previous;
            }
            else {
                contactDates.push(new Date(ee));
                contactDurations.push(contactDuration);
                contactDuration = 0;
            }
        })
        previous = ee;
    })
    contactDurations.push(contactDuration);

    timeSum2 = 0;
    e.timestamps2 = e.timestamps2.sort();
    var previous2 = e.timestamps2[0];
    var contactDates2 = [];
    var contactDuration2 = 0;
    var contactDurations2 = [];
```

```

contactDates2.push(new Date(previous2));
e.timestamps2.forEach(function(ee) {
    if(ee-previous2 < 900000 && previous2 != 0){
        timeSum2 += ee-previous2;
        contactDuration2 += ee-previous2;
    }
    else{
        contactDates2.push(new Date(ee));
        contactDurations2.push(contactDuration2);
        contactDuration2 = 0;
    }
    previous2 = ee;
})
contactDurations2.push(contactDuration2);

if(timeSum > minTimePref || timeSum2 >minTimePref ) {

    var minTime = 0;
    var maxTime = 0;
    var refContactDates = contactDates;
    var refContactDurations = contactDurations;
    if(timeSum >= timeSum2){
        minTime = Math.round(timeSum2/1000/60);
        maxTime = Math.round(timeSum/1000/60);
    }
    else{
        minTime = Math.round(timeSum/1000/60);
        maxTime = Math.round(timeSum2/1000/60);
        refContactDates = contactDates2;
        refContactDurations = contactDurations2;
    }
    var p = document.createElement("p");
    p.innerHTML = "ID: "+e.id+", Kontaktzeit zwischen  

"+minTime + " und "+maxTime+" Minuten";
    output.appendChild(p);
    refContactDates.forEach(function(e,i) {
        var pp = document.createElement("p");
        pp.innerHTML = "        -"+e+"  

Dauer: "+Math.round(refContactDurations[i]/1000/60)+" Minuten";
        output.appendChild(pp);
    })
    var sel = document.createElement("select");
    output.appendChild(sel);
    tmpBT = []
    e.foundBT.forEach(function(bt,i) {
        if(bt.length>0) {
            bt.forEach(function(b) {
                tmpBT.push(b);
            })
        }
    })
}

```



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```
    }
  }
})
return foundMatches;
}

function distance(lat1, lon1, lat2, lon2, unit) {
  if ((lat1 == lat2) && (lon1 == lon2)) {
    return 0;
  }
  else {
    var radlat1 = Math.PI * lat1/180;
    var radlat2 = Math.PI * lat2/180;
    var theta = lon1-lon2;
    var radtheta = Math.PI * theta/180;
    var dist = Math.sin(radlat1) * Math.sin(radlat2) +
Math.cos(radlat1) * Math.cos(radlat2) * Math.cos(radtheta);
    if (dist > 1) {
      dist = 1;
    }
    dist = Math.acos(dist);
    dist = dist * 180/Math.PI;
    dist = dist * 60 * 1.1515;
    if (unit=="K") { dist = dist * 1.609344 }
    if (unit=="N") { dist = dist * 0.8684 }
    return dist;
  }
}
```