Hygienic Behavior and (Non)Compliance during the COVID-19 Pandemic

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Abstract

Most of the rules put forth by the government as a response to the coronavirus target the behavior of people. Yet, during the coronavirus pandemic, few behavioral researchers have studied human behavior directly. Therefore, this study examined human behavior regarding virus transmission inside a local hospital in an explorative manner. The aim of this research was to develop an ethogram and a coding-scheme that allows researchers to reliably code and observe human behavior in natural situations. The data was explored in a qualitative and quantitative manner. In addition, logistic regressions were run to see if variables from the coding-scheme had predictive power on whether someone would violate social distance. We found that the more densely populated an area was the more likely someone was to violate social distance. This was also the case for attentiveness, and age, where less attentiveness and older age showed greater likelihood of being a predictor in social distance violation. The positive relationship between age and social distance violation was surprising and should be investigated by future research. The main finding of this research is that many people do not adhere to the rules. Some seem to try their best to adhere, but many do not. Certain conditions, such as high density, require an adaptive approach and the bending of rules.

Key words: coronavirus, virus transmission, behavioral observation, ethogram, social distance violation

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The coronavirus pandemic has now, as of February 2022, accompanied the world for about two years, and poses a major public health threat. Since the onset of the pandemic, few countries have remained free of the coronavirus. At the time this research was conducted, the world health organization (WHO) has registered more than 245,373,039 confirmed cases and 4,979,421 deaths that can be attributed to the coronavirus (*WHO Coronavirus (COVID-19) Dashboard*, n.d.).

The coronavirus disease is caused by the airborne coronavirus (Sars-CoV-2) and is highly infectious, especially under conditions of a lack of air circulation and proximity between individuals (*Coronavirus Disease (COVID-19)*, n.d.). Some of the measures that the WHO proposed are to wash hands regularly, to use hand sanitizer, to keep a distance of at least 1 meter to others, to wear a face mask, to cover mouth and nose when coughing or sneezing, and to restrain from traveling (*Advice for the Public*, n.d.). Once vaccines were made available, the WHO and other healthcare institutions strongly advised the public to get vaccinated.

The Netherlands, where this research was conducted, have adapted to these rules, and introduced the following as basic measures everyone needs to follow are wearing a facemask, the frequent and careful washing of hands, keeping a distance of at least 1.5 meters, to work from home as much as possible, and get tested if symptoms arise (Ministerie van Algemene Zaken, 2021a). There were some more specific measures in place which limit the number of guests one may host, for example (Ministerie van Algemene Zaken, 2021a). These measures change, however, as a response to a change in the number of infections. Throughout the process of this research, the measures have changed several times.

On the one hand, at the time this study was conducted, April and May 2021, the Netherlands found themselves in a period of relaxing the measures and the lockdown that had been ongoing since December 2020. On the other hand, the research also took place at the time when a third wave of infections hit the Netherlands. For the UMCG (University Medical Center

Groningen) in Groningen, a province which had been less affected than the Dutch average, this period was the busiest for the hospital during the pandemic, up to that point (H. Schultink, personal communication, May 2021).

In what follows, behavior related to the rules and measurements will be explored considering virus transmission. I will first outline the context for the local hospital further after which I will go on to highlight some insights from the current literature and theoretical psychological constructs.

UMCG

Hospitals are places where many people mingle: patients, staff, and visitors. Being a place that promotes health restoration, a hospital outbreak of COVID-19 infections would be detrimental. Unfortunately, the UMCG did experience such an outbreak. One patient died from the consequences of the corona virus infection and several staff members were infected too (*Besmette patiënt overleden na corona-uitbraak op C2*., 2021). Institutions such as hospitals have been in high demand since the pandemic started, which makes it especially important to prevent such outbreaks. Relevant here is also that the RIVM suggests that the workplace as such seems to be prone to SARS-CoV-2 infections (RIVM, 2021). This is an especially interesting aspect as the hospital does not represent a workplace for all who are present.

Accordingly, it is important for a hospital such as UMCG to restrict the chance of outbreaks. To do this, all individuals sharing the public spaces inside the hospital need to adhere to the same rules. This entail wearing a face mask, keeping a distance, coming alone, if possible, and more. These rules were communicated by posters and banners, stickers, and, at a later point in time, stewards also.

One relevant factor in enforcing hospital rules is that a hospital is populated by different groups with different knowledge, concerns, and roles. These different roles are likely to impact how individuals navigate through the space. Imagine a patient - they enter the hospital, directly find where they need to go, travel there smoothly, find a vacant chair, and get seen almost right

away timed it perfectly. Imagine the buzz that patient would feel to have succeeded as a prototypical hospital patient and how they would feel seeing other less prototypical patients getting lost or bumbling around.

Different individuals may also wish to satisfy different goals upon entering the space. A staff member might want to get to work or enjoy their break. A patient may want to get to the appointment as soon as possible, they may be late or anxious about it. A visitor may get the last chance to say goodbye to a loved one or welcome a new family member into the world. The meaning that the space holds for different parties involved can thus be approached from different perspectives. And the fact that multiple constituencies use the hospital complicates the communication of rules and information.

Prior Research

In the attempt to explain why and how people do (not) adhere to the directive put forth by the government, different areas of research are relevant. This paper will first look at the research about the coronavirus pandemic that already exists and will then move on to explore (social) psychological aspects.

Research on COVID-19

Current literature suggests that to decelerate the outbreaks and infections, measures such as social distancing are essential (Fong et al., 2020; Hoeben et al., 2020; Reluga, 2010). Evidence from previous epidemics and pandemics (Botsa & Ferguson, 2007; Caley et al., 2008; Hatchett et al., 2007) and computational simulations of COVID-19's spread support this (Ferguson et al., 2020). Correspondingly, the WHO encourages a distance, of at least one meter, to other individuals as essential. If this directive is not followed, an increased number of infections is likely. Research has shown that in an increasingly dense area the number of social distance violations also increases (e.g. Hoeben et al, 2020). If more people are inside a certain space, less distance can be kept by individuals. This is especially true for narrow spaces, and those with physical constrictions.

Other principles that decelerate outbreaks supported by literature also include the use of facemasks (Chu et al., 2020). More specifically, Chu et al. (2020) recorded a negative association between effective facemask use and virus transmission rates. Allegrante et al. (2020) also emphasize that the "only evidence-based preventive strategy currently available: population-wide behavior change" (p. 288) and that NPI's (non-pharmaceutical interventions) are necessary to reduce the spread in the immediate future (Chu et al., 2020; Haug et al., 2020). Overall and according to Haug et al. (2020), the most effective NPI's seem to be those limiting human contact and movement, and education of and communication with the public.

Hills and Eraso (2021) state that an essential aspect of NPIs is that they "primarily rely on population behavior change, which requires acceptance and more importantly, adherence to the measures" (p. 2). Hoeben et al. (2020) suggest that in certain locations, in this case the UMCG, social distancing behavior is not just a function of a person's willingness to adhere, but also their capability of doing so. Support for this premise can be found in the research by Hills and Eraso (2021) which states that a violation of social distance measures does not necessarily echo an individual's "willingness to comply, but their ability to succeed in doing so" (p. 18).

Research related to the coronavirus provides us with insights into the necessity and effectiveness of NPIs and human compliance behaviors. Furthermore, the importance of social distancing is made clear by not only this pandemic but also by previous epidemics (e.g. Botsa & Ferguson, 2007; Hoeben et al., 2020).

Looking outside the pandemic literature, one may also consider different psychological factors that may have a role to play in when, how, and why people do or do not adhere to the rules.

Psychological Mechanisms Influencing Rule breaking

There are different directions one may take when analyzing the psychological mechanisms that possibly play a role in the (non)compliance of rules. To begin with, it proves

useful to consider and investigate how individuals deal with the changes of rules and regulations.

In its simplest form, a rule is an "accepted principle or instruction that states the way things are or should be done and tells you what you are allowed or are not allowed to do" (Cambridge Dictionary, 2021). Thus, rule breaking can be conceptualized as the disregard and non-adherence of the way things should be done. Nevertheless, not all rule breaking must be due to bad intentions. Morrison (2006) suggests that "prosocial rule-breaking constitutes 60% of rule-breaking in a variety of industries" (Gosh & Shum, 2019, p.1). Ghosh and Shum (2019) further suggest that with a change in the intention upon which the rule-breaking behavior is based, the "nature and the types of rules broken may become different" (p. 2).

Hills and Eraso (2021) specifically looked into factors that would influence the (intentional) non-adherence to social distancing rules and found that "only 7.2% reported being able to adhere to all social distancing measures during the two-week period" (p. 17) studied, and almost half of the participants did not adhere on purpose (Hill & Eraso, 2021). This intentional non-adherence was related to decreased control over others distance, for example (Hill & Eraso, 2021, p.18). This is especially interesting in the current study's context. In the public spaces of the hospital, one cannot influence other people's behaviors directly, yet the space is shared by many, and one may need to adapt as a result. While walking through the streets during the pandemic, one notices that a flexible adaption to the rules is essential as there may be situations in which the social distance may not be guaranteed.

Besides factors such as intention to rule adherence, factors such as efficiency can also contribute to the non-adherence. Loyens (2014), for example, suggests that rules can be bent under conditions where "legality conflicts with other values, like effectiveness, efficiency …" (p. 62). Furthermore, rule bending involves the societal perception that sometimes it is okay, and possibly even encouraged, to bend rules to complete a task (Loyens, 2014).

As briefly touched upon above, rules were communicated through different channels at UMCG. In public spaces this was mainly achieved with posters, banners, and flyers. In the staff canteen additional stickers were on every table. This suggests that the two groups, namely staff and non-staff, were addressed differently. To further elaborate on this aspect, social identity theory is going to be explored.

Social Identity Theory

A communicative strategy employed by the government was to emphasize that 'we are in this together', essentially advocating solidarity and unity. This was also the case inside the staff canteen of the UMCG. Stickers on the tables suggested to keep a distance "for your own health and that of your colleague", "also think about others" (original: "voor je eigen veiligheid en die van je collega's"; "Bewaar 1.5m afstand; denk ook aan anderen!"). For the feeling of solidarity or unity to arise, we need to feel as though we are in this together, like we are one group – this is one of the key arguments of social identity theory (Haslam et al., 2009).

Social identity, according to Tajfel (1974), is a person's self-concept that originates from their knowledge of belonging to a group (Stets & Burke, 2000). This knowledge encompasses two things: a subjective sense of unity and a common understanding of what it means to be a group member. This includes knowledge of how 'we' see things and do things, influencing individuals' behavior (Hogg & Reid, 2006). These 'shared patterns of thought, feeling, and behavior' can be described as norms (e.g. Hogg & Tindale, 2005). One may argue that, for clear communication of the rules to occur, the same rules need to be communicated to all who are sharing the spaces. Due to systematic differences in exposure to rules, there may, arguably, also be systematic differences in how different groups inside the hospital think and behave. More specifically, one may assume that health-care workers can behave according to their group perceptions, as do patients or visitors.

If a patient enters the hospital, and rules and regulations are not communicated effectively, they may be unsure and due to the experienced uncertainty look towards the

members of staff to establish norms by which they are to behave inside the hospital (Gelfand, & Harrington, 2015). If members of staff, however, do not adhere themselves to the rules and regulations, they may portray an invalid norm towards the respective out-group. This mismatch of clear rules, regulations, and communication affects the public spaces and the behavior embodied within them.

Not only the channel of communication differed for different groups, but also the tone in which rules were communicated differed. Rules were communicated to patients and visitors in different ways. In other words, during the initial stage of the study, rules were simply stated on posters and flyers, but during the second phase, these rules were verbally communicated by hospitality staff members. Inside the staff canteen, however, the tone of the messaging was different. Here, no rules were communicated, rather tables had stickers on them indicating where to sit and where not to sit. These stickers' tone of messaging was a very different one, urging staff to think about their own and their colleague's safety, essentially highlighting the ingroup. This suggest that different norms were communicated to different in-groups. This, again, does not align with the picture of 'togetherness' painted by the government.

Taking these (social) psychological aspects into account, the current study will be outlined further in what follows.

Current Research

Although most of these rules influenced people's behaviors, behavioral investigations in relation to COVID-19 is a method rarely used. The main understanding researchers have gained concerning physical distance (non)compliance is acquired relying on self-report surveys (e.g., Olsen & Hjorth, 2020) and mobility reports. The current study investigates factors inside the public areas of the local University Medical Center that contribute to the (non)compliance of individuals using onsite observation. This will be done using an observational method. This method of studying human behavior allows to see how people behave in different situations. Situational factors are hard to capture in surveys, for example.

The focus of the current research is to develop an observational schema that allows researchers to reliably code real-life pandemic behavior within a hospital setting that is relevant to the implementation of behavioral standards that are safe. Because this research is explorative and employs an inductive, rather than a deductive approach, no specific hypothesis will be tested. Instead, associations between variables, such as individual and architectural factors, are going to be investigated. Based on the available literature discussed above, certain associations between variables can be expected. Based on the explorative nature of this paper, the development of the ethogram, the coding-scheme, the establishment of inter-rater reliability, and the exploration of possible correlations of variables will be outlined below in more depth.

In short, five steps will be established during the analysis. In step one, I create an elaborate, rich qualitative description of behaviors individuals displayed and situational factors, such as rush hours and architectural bottlenecks, observed during initial pilot work in the UMGC. In step two, I develop an ethogram. An ethogram is as an inventory of methodically defined and relevant behavioral patterns visible and diligently documented (Jones et al., 2016). The ethogram can be regarded as a behavioral repertoire of behaviors describing how people move around. In a third step, I apply this coding-scheme to structured behavioral observations and record human behavior in light of rule adherence and factors that may influence virus transmission.

This research is part of a bigger project which aims at aiding the UMCG in developing an intervention. This study will add to the current literature and can be used as a frame of reference for future studies that aim to employ behavioral observations. Additionally, it will add the ethogram based on human behavior during a very uncommon situation, the pandemic. Thus, offering an example to future research on how such a method can be employed.

Methods

Data and sampling

The data collection of this study took place in different phases. In the preliminary phase, unstructured observations were done in order to define and narrow the focus of the behaviors observed during the structured observations. In a second phase data collection took place.

Participants and Procedure

The sample consisted of randomly chosen individuals that were present in the areas of observation. The design of the study was observational and explorative.

The data of this study comprised of 1604 observations made in the UMCG. The structured observations took place in the months of April and May 2021. The study was approved by the ethics committee of the Faculty of Behavioral and Social Sciences, University of Groningen, (PSY-2021-S-0167) and the medical ethics review board of the university medical center Groningen (METc UMCG; 202000901). The researchers, two master students of this project, regularly visited the UMCG to conduct in-situ observations of people present in the public spaces. The observations had two distinct phases. The preliminary observations which were unstructured and used to inform the development of an ethogram, and the structured observations in which the quantification of the behaviors, individual and situational variables of interest were recorded. These two phases will be outlined below.

Preliminary Observations

Prior to the structured in-situ observations, we spent about three months carrying out preliminary observations[1]. These preliminary observations were made in public spaces such as shopping-malls, supermarkets, and parks, in addition to the spaces inside the hospital. This had different purposes. Some of them were to get acquainted with the nature of conducting observations, others to test how many variables we could record on one individual in a limited time, and to gather more intel on how individuals behaved in different spaces. A question asked

[1] This process took such a loon time because we went through different approval and ethical clearance processes. In order to start with the structured observations, we had to wait until we received all approvals and clearances.

during these initial observations was, for example, whether queuing behavior is different inside a mall, in front of a café, and inside the hospital. Another point of interest was, for example, how individuals move through different spaces, with more or with less room.

Throughout the process of preliminary observations, we gathered a list of locations that we thought were best suited to observe a range of behaviors and where these behaviors would occur frequently. To gain a more crystallized idea for how people move and behave in different spaces, we immersed ourselves in those by spending time in these places, observing from a distance, or moving through those areas as one of the crowds. To illustrate, I may have spent an afternoon taking walks through the local park while observing how individuals would or would not make space for one another. We would stand in line to get coffee, for example, while observing how individuals behaved in the queue in front and behind us, and how they would respond if we positioned ourselves differently. All observations were recorded using either a notepad, reflecting on them on a shared drive, or through the use of voice recordings. All notes we took were later saved on a secure shared drive which allowed all involved researchers to access these. Observational positions were chosen so that we had an overview of the events unfolding in the chosen locations, while being part of the bigger collective of individuals present. This is because as researchers we had to be a "subjective participant in the lives of those under study, as well as an objective observer of those lives" (Angrosino, 2007, p. 14).

These three months of preliminary observations and notes made clear that a structured code book and an ethogram would be essential to document the behavior people displayed. The preliminary observations, especially inside the UMCG, were made at different days through the week and at varying times of day to make sure that the observations contained as much variation as possible. Doing observations at different times during the day inside the hospital showed, for example, that there are certain peaks throughout the day during which more (non)compliances could be observed. These were shift changes, in the mornings around 7:30 and in the afternoon around 16:00. We observed, for example, that in the morning, before the shifts start, many staff

members arrive at the same time which results in a very busy entrance hall and less room inside revolving doors. As will be elaborated on below, this led to violations of social distancing rules in some cases.

Structured Observations

The structured in-situ observations took place three days per week for three weeks, at the same times during the day. In addition, three separate days were utilized to record observations that would be used in the inter-rater reliability testing. To assure randomization among subjects, the observing researcher observed every fourth person that entered the scene. We did not randomize the observations for the inter-rater reliability in such a way. Rather, before we would start an observation, one of us would signal which individual was going to be observed. For both scenarios, we observed the individual until they left the scene, or for a maximum of 1 minute, while recording the behaviors the individual engaged in. These observations were recoded using voice recordings on the researchers' personal mobile-devices, these were smartphones, an I-phone 11 and a Samsung Galaxy S7. This ensured that the observations stayed unobtrusive, as it may have looked as though we were taking a call. To make the observations as unobtrusive as possible, we used the seating opportunities within the public spaces to sit and observe. We wore our UMCG-staff passes and mingled among the individuals present at the time. All recordings were stored on a secure shared drive of researchers involved in this study. In the case that someone would come up to ask us what we were doing, we always carried information leaflets with us stating what we were doing and why we were doing it. In addition, contact details from the supervising researcher were given as well in case the individual would like to ask for further information.

Measures

During the observations, different variables were of interest. These included, for example, density, locomotion, mask-wearing, and sanitization of hands. The full list of behaviors and variables observed can be found in the coding scheme (Table 4).

Observations

Observations were completed in April and May of 2021 during a three-week period. Observations were done on three weekdays per week, Monday, Tuesday, and Wednesday. On Monday and Tuesday observations were conducted at the main entrance, on Wednesdays they were carried out by the fountain area. We started observing the main entrance at approximately 7:30 each morning, the observations in the area around the fountain began around 8:30 each observation day. We ended observations if enough individuals had been observed, this approximated to around 120 individuals per observation day, and equated to approximately 16:00.

Context

Observations were carried out in two spaces of the public areas inside the UMCG. The spaces were selected based on earlier preliminary observations. These preliminary observations were made to identify the spaces best suited to observe the behaviors of interest. The spaces that were selected for the structured observations were the entrance hall and the area around the fountain (see Appendix B & C). The entrance hall was selected because it hosts the main entrance, an information desk, a staircase towards the parking garage, a waiting area, the ER, a florist shop, and a little supermarket. This space hosts many people who all move to different destinations. In any given moment, people may be entering the space through the main entrance, the staircase, the corridors, or a side entrance (mostly staff members). They may go straight ahead to the information desk or the ER. People may also go to the left or right to get to the east and west hallways. Additionally, people leaving, coming in, and those using the space to pass through will encounter each other.

Importantly, this is the first point of "contact" individuals will have with the hospital environment, its rules and regulations, and possibly staff and other people present within the space. During the first week of observations the set up was as depicted in Appendix B. A person coming in through the revolving door can take one of two lanes, once they are inside. At the

end of these lanes dispensers with hand sanitizers were placed. These lanes were unmanned and rather disorganized (e.g. not same in width and number of lanes leading inside and outside). Appendix D shows the set-up after the hospital set up their intervention. This intervention was the hospitals answer to the "code-yellow" they were in during the time of observations.

This intervention was set up in the following way (see Appendix D for a rough sketch): two lanes through which people can enter via the main entrance, and one entrance line which comes from the car park, two lanes used to exit the building. At the end of the lanes, towards the center of the room, sanitizers were placed. In addition, tables with stewards were also present. These stewards asked every individual to sanitize their hands and wear a face mask. If an individual came into the hospital not wearing a face mask, they were provided with one by the stewards. Stewards additionally reminded pairs and small groups that they may only enter together if really necessary. These stewards and the lane system were present throughout the whole building at entrances accessible to the public. This intervention was present during week 2 and 3 of the observations. There were no new observations made after the intervention was removed from the space as this was not in the timeframe of this study.

The fountain area was selected because it hosts several possibilities for people to spend an extended amount of time, meet, and use the space to get to different hallways and polyclinics. For example, a to-go coffee shop, seating possibilities around the fountain and additional benches are also present. Additionally, this area is adjacent to a busy intersection which connects parts of the hospital. This means that many people move through the space and use it as a transit area. This space is further used by UMCG-staff for transportation means such as golf carts to drive patients and visitors, and other staff members on vehicles transporting letters, medicine, or other medical devices. However, these two spaces hold structural differences, such as the presence of hand sanitizers in the foyer and the lack thereof in the area around the fountain.

Coding

Myself and another master's student coded our own voice recordings of the observations. We coded variables according to the coding scheme that was constructed before the observations took place. The full coding scheme will be further discussed below, and the coding scheme is visible in table 4.

Analysis

The observations were analyzed in an explorative manner. The analysis will be separated into five steps. These steps will represent rich descriptions, developing the ethogram, constructing the coding-scheme inter-rater reliability, and the exploration of correlations. The data will also be analyzed statistically using correlations and logistic regressions.

Results

Step 1 Rich Descriptions

To elaborate on the behavior displayed by people, some observations will be illustrated. The observations that were described were selected because of the value we attached to them in the process of forming a better impression of the behaviors displayed and the (situational and other) factors influencing these behaviors. Examples from three major categories were chosen to illustrate some examples, namely, distance keeping and social-distance violations, mask wearing behaviors, and that of people in motion, respectively locomotion.

Distance Keeping

During the preliminary observations, we found that most of the time, people do not adhere to the guidelines of 1.5-meter distance between them. A typical description of a scene where people are less inclined to keep their distance will also be elaborated upon.

Deaf. On one occasion, two individuals were observed communicating using sign language. These individuals walked through the space while keeping a recommended amount of distance between them, in comparison to non-deaf individuals surrounding them who did not keep enough distance. Because these two individuals kept their distance, it was more visible that others did not. At the same time, the fact that they were so clearly "different" in their use

of sign language seemed to have given others a cue that the people signing may require more space, which is why others seem to have given them more space and accommodation. In this instance we see that, on the one hand, keeping distance is rare, but on the other hand, it is a collaborative act that requires participation from those in the broader environment. An inference made from this is that distancing is only upheld if all done together.

Blind. During another preliminary observation, I saw an individual with sight impairment walk along one of the walkways inside the hospital. This was during the late afternoon, which means that the public areas were not overly crowded and relatively quiet. Those individuals walking past the impaired individual kept distance so that the individual had the space to navigate through the space more effortlessly. As soon as the other individuals passed by the impaired individual, they did not seem to have much regard for the distance kept to other individuals. In a similar fashion as above, individuals seemed to have perceived a cue signaling the vulnerability of the impaired individual which led them to provide more room for that individual. Again, the fact that they did keep distance to the impaired individual highlighted that distance keeping is generally not strictly adhered to.

Hurrying. In a hospital there are many people who walk fast to reach their destination quickly. Generally, individuals who need to get to their destination as quickly as possible, seem to violate the physical distancing more often. Individuals who hurry often non-verbally signal to those around them not just that they are busy, but also that they are preoccupied–meaning their focus is not on those around them but on another task or objective they need to see to. This may be a doctor or a nurse who needs to get to a patient as soon as possible and may already be thinking about possible procedures or diagnoses. This may influence the attention they pay to their surroundings, leading to more frequent distance violations. As a perceiver, it is almost as if they signal while walking: I am in a hurry, it is an emergency, it is important. People who hurry through the hospital do so in a fast-paced manner. They may stop to accommodate someone or as a result of encountering an obstacle. They overtake people along the way, which

is where many of the violations occur. Drawing from this, one may assume that people sometimes have different purposes of hurrying. Since the hospital is a place that provides a work context for employees but a different context for patients and visitors, employees who need to hurry may commit fewer violations, if again, people work together in keeping their distance to everyone around them and accommodating those in need of said space.

Stewards. As mentioned above, during two of the three weeks of observations, stewards were placed at the entrances of the UMCG. Upon entering the hospital, one would need to take one of two lanes leading towards the table with the stewards, where the hand sanitizing would take place. The stewards wore a highly visible vest saying "please keep your distance" on the back. While the hand sanitizing took place, stewards may ask whether it is clear to the visitor/patient where they need to go and provide directions. The main purpose of the stewards was to check whether everyone wore a mask, to remind people to sanitize their hands, and to ask people, if they were in company, whether the company was necessary and whether they could wait for the patient outside. The plexiglass screens that were placed on the tables behind which the stewards could position themselves were rarely used. In many instances the stewards made a step towards the other individual(s) to explain the hand sanitizer, for example, or to better understand a question that was asked to them. In some cases, this would end in a brief chat between the stewards and the individuals where either the steward or the individual(s) would lean in further to be more audible and to understand the other person better. This supports the suggestion that violations occur in naturally occurring social interactions and not as purposeful acts.

Mask Behavior

During both the preliminary and structured observations, we were able to observe that the majority of individuals wore a mask. There were also instances of individuals wearing them beneath their noses, and examples where individuals wore alternative face coverings, such as a face shield. Although the adherence to wearing a mask was generally relatively high, there were

situations in which many individuals did not wear them. These situations usually involved a social interaction, such as drinking coffee with a colleague. This will be further elaborated upon in what follows.

Important to note is that during the observations of people entering the building, some individuals would already be wearing their masks as they entered the building and others would only put them on once they were inside, and others may also adjust their mask at a later point in time. This shows that the recording of mask wearing behavior is more complex than a simple yes/no measurement as to whether the individual is wearing a mask.

Removal of Mask. It is clear to most that to eat and drink one needs to remove their mask. However, some individuals seem to forget to put the masks back on afterwards. This would mostly occur when they continued a conversation during a break, for example. We were also able to observe differences in the removal of masks to drink and eat among different individuals. Some would slide their masks below their mouth to take a sip or a bite of something and immediately put the mask back over their mouth and nose. Others would either take the mask off completely or wear it just below their chin for the whole meal, drink, or coffee-break. Some individuals would even refrain from wearing their masks during the whole time they were sitting down to drink and eat, even after they were done. Usually, masks were adjusted only when the individuals got up and left the table. An inference that can be made from this is that people do adhere to the rules, yet, they may apply their own individual interpretation of the rule and deviate from it when deemed necessary (e.g. to eat).

Walking/ Locomotion

While taking a closer look at how exactly people move through space, it became clear that there were several categories of how an individual can walk through the space. For example, especially around the lunch break many members of staff seemed to be rather hurried. Moving in a hurried manner entails overtaking other people, for example, and while doing so, the distance kept towards others may be violated. Other individuals walk in a very slow or stop-

and-start manner—sometimes looking around and standing still in the middle of the hallway. These individuals were nearly posing an obstacle to those moving through the space in a well-mannered and rather "speedy" fashion. These 'slow' individuals may not know their way around and are trying to orientate themselves while walking. They may look around and stop suddenly to reassess their location. We interpreted their behavior as being lost or as wandering around.

Other sub-categories in the locomotion categories included: purposeful (i.e. individual seems to know where to go and does so in a well-mannered and average walking speed); casual (i.e. individual seems to know where to go but does not seem to be in a rush, walks slower than average); and hurrying (i.e. individual seems to be under time-pressure, walks in a seemingly stressed/hurried manner). Differences of these categories were observed among staff, patients, and visitors. Members of staff were most likely to walk purposefully, except when it, presumably, was their break and they walked casually. Visitors and patients would walk more casually or in a strolling manner, due to possible impairments or illnesses.

Step 2 Developing the Ethogram

The rich descriptive examples above illustrate what we witnessed during our on-site observations. These descriptions are central observations to the next steps of the analysis. What we were able to observe was that people generally behave in a pragmatic manner while trying to keep to the measures as much as possible, illustrating that they are not intentional rule breakers. On the flip side of the coin, however, we also see that people rarely seem to try to prevent violations from happening, and that rules are broken quite casually. I.e., a doctor who needs to hurry to the ER will probably violate some distances while moving through busy corridors and walkways in order to reach the patient as soon as possible. This, however, likely occurs without intention to violate the social distance regulations towards other individuals, but rather because the doctor needs to be as fast as possible while navigating through the people.

The first descriptive step of the analysis helped to inform the development of the ethogram in step two. While ethograms are relatively common in animal observational research, not many are found in the current behavioral literature within the social sciences. An ethogram is an unstructured table (table 2 & table 3) which includes general descriptions of the behaviors observed in a setting of interest (Jones et al., 2016).

Constructing an ethogram entails creating a list of observable behaviors for this space with clear descriptions of those behaviors. Ethnographic methods can be defined in a number of ways. They can be "field-based", "personalized", and "inductive", among others (Angrosino, 2007). The ethogram for this study was constructed and developed throughout the study and aimed at informing a systematic code-book. The ethogram includes a general description of the behaviors. As will be elaborated on below, there are certain behaviors that may be displayed at different degrees of intensity by individuals.

To construct the ethogram, an exhaustive list of observable behaviors was compiled. In a next step, the behaviors on the list were collapsed into broader categories (Jones et al., 2016). Categories and the behaviors entailed in those were observed again, in iterative fashion, to see if further categories needed to be formed or categories needed adjustment.

Step 3 Constructing the Coding Scheme

Based on the ethogram and unstructured observations it became clear that to allow us draw conclusions and recommendations about distancing behavior, a coding-scheme that helps to systematically record behavior surrounding COVID-19 precautionary behavior would be of essential utility. The rich descriptions entailed in the ethogram helped define variables to be included in the coding-scheme. Observations were recorded and coded according to the coding scheme (table 4).

Whereas the ethogram is a rather unstructured table with broad descriptions of the behaviors and categories, the coding-scheme is developed based on it to be easy in its use and applicable in field settings without too much subjective interpretation and second-guessing of

motives. The coding-scheme contains all categories and levels of intensity as in the ethogram; however, variables are only shortly described, and codes are provided for each variable. The main goal of the coding-scheme is to make it easily usable for observers, whereas the aim of the ethogram is to give rich descriptions of behavioral categories.

Step 4 Inter-Rater Reliability

To assess the reproducibility and consistency of codebook observations between the two on-site observers, we carried out inter-rater tests of reliability (IRR). The values for the inter-rater reliability were calculated including both observational areas, the hospital entrance and the fountain. The IRR analysis included 65 observations. The variables that were coded were the same variables that were coded during the structured observations (see table 4). We found that for most of the variables there were no notable differences in the levels of interrater reliability between areas, except for the variable "density". This will be elaborated on below.

Inter-rater reliability was calculated and reported using the Krippendorff (2004) alpha and the Landis and Koch (1977) values. The benchmarks from the Krippendorff (2004) alpha and the Landis and Koch (1977) differ somewhat, with Krippendorff (2004) benchmarks being more conservative. Landis and Koch (1977) consider alpha values of 0.61 - 0.8 as "substantial", whereas Krippendorff (2004) considers values ranging from 0.67 - 0.8 as "allowing for tentative conclusions". Both values are reported in Table 3. It is also important to note that values that are categorized as tentative will be considered as satisfactory/supportive evidence in this context, as supported by Lombard et al. (2010) suggesting tentative values to be appropriate in exploratory studies. Hallgren (2012) put forth that Krippendorff's values were designed for the use of textual content analysis, and are, hence, too conservative for behavioral observation.

Variables that researchers reached perfect interrater reliability (i.e., scored an alpha of 1) include "company", "hands not free", "mask", "mask specific", "sanitizing", and "waiting in non-sensible area". Other variables with alpha levels above 0.8 were "social-distance violation specific", "age", and "sex". Variables within the limits of tentative and substantial

were “accommodation”, “attentiveness specific”, “locomotion specific”, “queues”, “queueing”, and “social behavior”. The variable “density” had an alpha value of 0.47. As compared to the other variables coded, density appears to be a rather complex variable to code as the number of people present in the space at the time of recording may vary, based on the interpretation of the researcher. This may represent a temporal mismatch between coders of when they recorded the density of the space or be due to the different vantage points between researchers. All inter-rater reliability values can be found in table 1.

As for the variables “prosocial behavior”, “sudden obstruction”, and “waiting in sensible area” no alpha could be calculated as these behaviors did not occur during the time of the inter-rater reliability observations. Consequently, results including these variables will be interpreted tentatively. What is essential here is, however, that the researchers did agree on the *absence* of these rarer behaviors.

Step 5: Statistical Analysis

The final dataset consisted of 1604 structured observations. Of these, 829 individuals were observed in the entrance area and 775 in the fountain area. The datasets for these two locations were analyzed separately due to differences within the set of variables recorded at each location. This means that the variable of sanitizing hands, for example, was not recorded in the fountain area. This was because people did not have to sanitize their hands upon entering the area. In addition, there were few possibilities for people to sanitize their hands in this area. Because sanitization was not necessary to enter this space, the variable the variable defining whether a person is carrying something in their hands is also redundant.

Tables 5 and 6 present descriptive statistics for the entrance and the fountain areas, respectively. The average age of individuals observed in the entrance area differed slightly (M= 46.31, SD= 17.49) than to those observed in the fountain area (M= 48.85, SD= 17.54). The specific attention observed in both areas was very close to equal where individuals observed in the entrance area were almost as attentive (M= 1.31, SD= .58) as those in the fountain area

(*M*= 1.35, *SD*= .43). The density observed in the entrance area was greater *(M*= 7.37*, SD*= 4.45) than in the fountain area (*M*=3.00*, SD*= 1.68). Individuals violated social distance more often in the entrance area (*M*=.53, *SD*=.49) than in the fountain area (*M*=.33*, SD*=.46). Individual in the entrance area were observed to be in company less times (*M*=.25, *SD*=.43) than individuals in the fountain area (*M*=.31*, SD*=.46).

To draw conclusions from the observations and establish possible links between variables, the data was analyzed using a logistic regression. In addition, the variable density was visualized using the Loess curve. This provides insight into how the density may fluctuate throughout the day.

Loess estimates

A local weighted regression using the Loess method was applied to gain insight into how the density would fluctuate throughout the day. The Loess curve can be used to detect trends in the data. A "jitter" function was also applied to disperse the data points for easier visibility and assessment.

For both areas, three plots were produced (see figures in Appendix A). Figures 1 and 4 present the number of violations in the respective area (y axis) and the time of the day (x axis). Figures 2 and 5 present the density in each area (y axis) plotted against the time of day (x axis). Figures 3 and 6 show the number of violations in each area (y axis) and the density in each area (x axis).

In figure 1, the number of violations in the entrance area are visualized at different times of the day. The association seems to be slightly positive as the number of violations increase during the day. Looking at the graph, one can see that the violations in the morning hours accumulate around zero to one violation. This seems to be more distributed in the afternoon hours as more data points gather around two and three violations as well, showcasing the increase of violations during the day.

The plot in figure 2, mapping the density at the entrance against the time of the day, shows a positive linear association. The effect can be said to be strong as the confidence intervals are rather small.

The plot in figure 3, number of violations plotted against the density in the entrance area. There is no clear association visible. Additionally, there is an outlier which was also excluded from the logistic regression.

In figure 4, the number of violations is plotted against the time of the day for the fountain area. Here, there is a linear increase of the number of violations up until noon, respectively, lunch time, after which the number of violations seem to decrease.

Figure 5 displays the density in the fountain area plotted against the time of day. This association is negative. What is visible when looking at the plot is that the data points accumulate between 12:00 and 16:00, and at a density round two to five. In this frame of time, the density did reach a maximum of about eight individuals being present within the fountain area, however, the data points are more dispersed. After 16:00, the density decreases.

Figure 6 displays a linear increase of violations and the density in the fountain area. The increasing confidence interval and the slight downward slope of the tail end can be ignored as it does not seem to have in influence.

A general pattern that can be detected by looking at the scatter plots; one can see that as the density increases more social distance violations are committed.

Logistic Regression

A series of forced binominal logistic regressions were conducted in order to assess whether codebook variables have predictive value and whether they had an effect on social distance violations. This allowed us to go beyond assessing the reliability of our coding framework to assess the utility of the behavioral coding scheme in predicting social distance (non)compliance.

First, a forced binominal logistic regression was performed to determine whether age, the degree of attentiveness, whether someone was in company, their gender, and the density in the area predict whether an observed individual violates social distancing.
This was done for both the entrance and the fountain area, respectively.

The binominal logistic regression model, for the entrance area, was statistically significant ($\chi^2(1) = 57.253$, $p < .001$) and explained 11.7% (Cox & Snell $R^2 = .117$) of the variance in social distance violation. The degree of attentiveness was a significant predictor of social distance violation. As such, those who were less attentive were more likely to violate social distancing. The odds ratio of 3.053 shows that with a one unit increase in in-attentiveness, an individual would be 3.053 times more likely to violate social distance – this represents a medium effect (Chen et al., 2010). Age was also a significant predictor of whether someone would violate social distance. As such, an older individual was more likely to violate social distance. The odds ratio of 1.027 shows that with a one unit increase in age an individual is 1.027 times more likely to violate social distance – this represents a small effect (Chen et al., 2010). The binominal regression model for the fountain area was also statistically significant ($\chi^2(1) = 76.460, p < .000$) and explained 10.9% (Cox & Snell $R^2 = .109$) of the variance in social distance violation. Three predictors showed a significant effect. As in the entrance area, the degree of attentiveness was a significant predictor of social distance violation. The odds ratio of 1.602 shows that with a one unit increase in attentiveness, an individual would be 1.602 times more likely to violate social distance – this represents a small effect (Chen et al., 2010).

Whether an individual was in company was also a significant predictor of social distance violation. The odds ratio of .521 shows that with a one unit increase in company, an individual would be half as likely to violate social distance - this represents a small effect size (Chen et al., 2010).

The density of the fountain area was also a significant predictor of social distance violation. The odds ratio of 1.517 shows that with a one unit increase in density, an individual

would be 1.517 times more likely to violate social distance - this represents a small effect size (Chen et al., 2010).

Discussion

To suppress the speed at which the coronavirus spreads, it is essential to limit contact between people (e.g., Chu et al., 2020; Reluga, 2010). Therefore, most of the directives in place throughout the pandemic have focused on the human interaction by, for instance, limiting the number of people one may see and the distance kept. It, consequently, makes sense to investigate human behavior in the transmission of the virus. Most studies within this area, and especially those concerning the coronavirus, have relied on self-report data in surveys. As Hoeben et al. (2020) put it, such work "captures people's intention to comply with directive, rather than their actual compliance behaviors" (p.17). To the best of my knowledge, studies investigating human behavior during this pandemic are extremely rare.

To investigate possible antecedents of social distance violations, behavioral observations were made. These were analyzed in quantitative and qualitative manners. A key finding of this study was the observation that people seem to try to stick to rules and make an effort to behave accordingly, yet it is also apparent that many do break the rules. From the (un)structured observations came forth that the adherence to directives may be influenced by situational cues and circumstances, indicating that we do not have typical rule followers and rule breakers but rather observe a pragmatic and adapted interpretation and application of the rules depending on the situation. An example situational cue may be the perception of a vulnerability cue. In such situations people would provide the space needed for the more vulnerable individual to move safely. Circumstances may be architectural bottlenecks, densely populated spaces, or social interactions. For example, on the so called "Winkelstraat", the walkway where different shops, staircases, and staff-support units are located, many individuals struggled to maintain the advised distance, especially during busy times. During the rush-hour, for example, many staff members move through this space, additionally golf carts may also

move through the street, which take up a considerable amount of room. This implies that there are architectural barriers hindering individuals to fully comply with the rules and regulations. These could be narrow walkways or columns that take some space from the walkways.

Throughout the observations, it became clear that distance keeping is a social act in which people need to cooperate. Upon the perception and interpretation of a vulnerability cue (e.g., blind person), people made space for those vulnerable. In some cases, people might use gestures to signal someone that they will have the space to walk and occupy the space. These both are based upon an interaction between people.

In essence, the observations show that many people do not adhere constantly and adopt a pragmatic approach to the rules and regulations. Important to note, however, is that the results presented in this study are anecdotal for the most part. The data was, additionally, analyzed with logistic regressions. These were able to support the premise that attention, an individual's age, whether someone is in company, and the density of the area are statistically significantly associated with whether someone would violate keeping a social distance. For the entrance area, for example, the less attentive and the older someone was seemed to be the more likely they were to violate social distance. The positive relationship between attentiveness and social distance violation was expected and showed a medium effect size, however, the positive relationship between age and social distance violation is somewhat surprising with a small effect size. One explanation for the relationship might be that most individuals observed were older. People that violated social distance were, on average, 6 years older than those who did not violate distance. For the fountain area, attentiveness, whether someone was in company, and the density of the space influenced whether someone was more likely to violate social distance. These relationships were expected, however, all of them showed a small effect size in this sample. The statistical analysis of such relationships is something that future research may focus on.

Implications

Theoretical Implications

In this study, we demonstrated that it is possible for researchers to reliably code human behavior in the Covid-19 pandemic, including more complex social behaviors. This is positive as it allows research to learn from the current study in relation to human behavior which will add novel insights to the current social sciences. This finding has further implications for how we currently conduct research. Although this research design (on-site observation) was relatively easy to apply, it is rarely applied in the field. Important to point out is, however, that this research design was very labor intensive in the initial phases. Once the coding scheme was developed and validated, it becomes easier to apply. Research seems to be preoccupied with innovative designs, instead of using simple instruments, such as one's eyes to see and observe what is transpiring. Hoeben et al. (2020), for example, highlight that those studies investigating behavior rely on self-reports bring biases with it.

This paper offers support for previous findings. One such finding already put forth by Hoeben et al. (2020) is that there seems to be an increased number of social-distance violations the denser an area becomes. The degree to which social distancing influences the transmission of the coronavirus was not assessed in this paper and can thus only be inferred from the existing research. Although no inferences can be made as to whether the lack of social distance inside the UMCG led to an increase in infections, this research sheds light on how people can behave in circumstances as those present. We have seen a pragmatic approach to rule adherence which supports Loyens (2014) statement that sometimes, rules are bent under conditions of efficiency, for example.

We have also seen that norms were communicated differently to different groups (i.e., staff and non-staff), indirectly highlighting different group norms. This links back to the research and messaging highlighting the togetherness and group identity of people in this pandemic. This is support of Young et al.'s (2021) research that suggests that with the aim of prompting "voluntary distancing… unified and consistent messaging" (p. 5) is required.

Practical Implications

The current study also offers insights and implications for practitioners aiming to design behavioral interventions, and the UMCG specifically. Through the analysis and the observations, it became clear that there are certain architectural aspects that have an impact on the way people move through a given space. In this case, this may imply to structure traffic flows differently for the areas with bottlenecks, such as the "Winkelstraat". One should, however, consider that such a restructuring may interfere with the seamless working of a hospital and is difficult to change.

How rules applicable to the UMCG are communicated is of importance. As described, the narrative in the communication was different between employees and patients, respectively visitors. If the perception and feeling of unity is addressed, it may change the norm towards one of 'we are in this together' and 'we follow the rules for the safety of others and ourselves' (e.g., Haslam et al., 2009; Hogg & Reid, 2006).

Another practical implication that can be drawn from this research is to consider moving such an intervention, as implemented in the entrance area, outside of the building. If individuals would arrive at the UMCG without a facemask, they could be offered one outside which would allow them to enter the hospital protecting not only themselves better, and those around them. Another advantage, of moving such an intervention outside is the increased space people would have inside to move around. An important point to consider, is, however, that the movement of the intervention to the outside may not be feasible due to weather and safety conditions, especially during the winter months.

Lastly, the instrument that I developed in this paper, can be used by hospitals in the case of designing interventions, as in this case. The coding scheme may be adapted to different hospitals. Nevertheless, once personnel is trained in observing people and seeing certain interactions this method may be applied in an iterative way to assess different phases of an intervention. This allows institutions to become aware of possible bottlenecks and shortcomings

and adapt parts of the intervention, accordingly, possibly enhancing the effectiveness of such an intervention.

Limitations and Future Research

Although the study provided useful insights, it also has some limitations. First, the operationalization for the density measure needs refinement. Though resulting in a tentative inter-rater reliability value of .47, there may be aspects influencing the slight disagreement in recording the density measure between the two researchers. Density is a measure that can change drastically within one observation as both areas that were studied are places where many people can move through in a short matter of time. Additionally, this variable was recorded by the observer's eyesight and an estimated judgement which invites human error in and of itself. Differences in the recorded density between the two researchers may occur due to a different order of recoding the variables, for example. Different observational positions may also have led to different radiuses the researchers were able to observe, influenced by possible obstructed views. Future research would benefit from operationalizing density fitting to the environment in which it will be observed and positioning observers in such a manner that will allow an adequate view of the to be observed behaviors. Additionally, mobility data used in other studies on human behavior may be a useful addition here.

Second, the study consisted of two conditions in which the observations were made. In week one, there was no in-house intervention, whereas in week two and three, the hospital had responded to the increasing cases of COVID-19 with an intervention. This consisted of stewards at the entrances who checked if people wore their masks, for example. Additionally, minor details changed throughout the intervention, such as the width of the lanes or the type of hand sanitizer apparatus provided. Although this is not essential in the construction of an ethogram and the coding scheme, it limited the researcher's observations to two conditions only.

In the future, researchers may want to establish channels of communication with the client, in this case the UMCG, to be aware of changes to the area of interest before they happen.

Of course, during the pandemic things can change very quickly and communication towards researchers may not be as important as other hospital management aspects.

Third, this study is limited to one hospital. We cannot determine the generalizability of these results to other hospitals and institutions. The UMCG, as other hospitals, will present their unique characteristics. One such unique characteristic may be the architecture, which may or may not, comprise of bottlenecks. It is possible that those unique conditions in the setting mean that the behaviors displayed in UMCG do not map completely onto the behaviors in other hospitals: the ethogram and coding scheme would then be less applicable in other settings, and the behavioral findings would be relevant to this setting more so than others. In order to increase the generalizability, researchers should consider conducting such research in different environments. This may not only increase the generalizability, but also shed light on the reliability of codes for different environments.

Fourth, the operationalization of the measure of whether, and how, someone is wearing their face masks has also been proven to be rather difficult. One point to consider here is that an individual may enter the hospital wearing no mask and put it on while walking to the hand sanitizer. Another option is that the person will only put it on when reminded by the steward. These were scenarios, such as this, that we did not account for when constructing the coding-scheme. Resultingly, these nuances have not been recorded. Rather, we recorded if someone was wearing a mask, and in which manner (i.e., correctly, beneath the nose, on their chin, or an alternative). This shows that even simple observations may be more than a simple yes or no. This also adds complexity not only to the analysis and observations, but also to the depth of human behavior and our judgement thereof. In the future, researchers would benefit from also considering such seemingly small details.

Conclusion

Much of the social and behavioral literature relied on surveys and mobility data to assess people's behavior during the coronavirus pandemic. In this study, we were able to

construct and test the usefulness and reliability of a coding-scheme that can be applied to observations of behavior in situations in which mobility data are not informative. Unlike mobility data, this instrument can be used, albeit in a very simple way, to interpret behavior that people display. The coding scheme is much richer than just mobility: mobility does not say anything about violations for instance. This study was conducted in a local hospital which poses its unique characteristics reducing the generalizability of the findings, yet, offered valuable insights into how people deal with regulations put forth by governments and the application thereof in day-to-day life. The social sciences would benefit from further testing the predictive value of behavioral observations on virus transmission, benefitting public health and, policy making.

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Table 1. Inter-rater reliability

						Level of agreement
Variable	N coders	N cases	N decisions	K alpha	Area of assessment	Landis and Koch, 1977	Krippendorff, 2004
Accommodation	2	150	300	0.79	Entrance and fountain	Substantial	Tentative
Age	2	144	288	0.86	Entrance and fountain	Almost perfect	High
Attent. Specific	2	150	300	0.81	Entrance and fountain	Almost perfect	High
Company	2	151	302	1	Entrance and fountain	Almost perfect	High
Density	2	145	290	0.47	Entrance and fountain	Moderate	Low
Hands not free	2	63	126	1	Entrance	Almost perfect	High
Loco specific	2	150	300	0.8	Entrance and fountain	Almost perfect	High
Mask	2	151	302	1	Entrance and fountain	Almost perfect	High
Mask specific	2	151	302	1	Entrance and fountain	Almost perfect	High
Prosocial B.	2	150	300	N/A*	Entrance and fountain		
Queueing	2	64	128	0.74	Entrance	Substantial	Tentative
Queues	2	58	116	0.79	Entrance	Substantial	Tentative
Sanitizing	2	64	128	1	Entrance	Almost perfect	High
SD vio specific	2	165	330	0.88	Entrance and fountain	Almost perfect	High
Sex	2	151	302	0.97	Entrance and fountain	Almost perfect	High
Social B.	2	151	302	0.67	Entrance and fountain	Substantial	Tentative
Sudden obstr.	2	-		N/A*	Entrance and fountain		
Waiting n-s	2	64	128	1	Entrance	Almost perfect	High
Waiting s	2	-		N/A*	Entrance		

Note. N/A= the behavior was not observed during the IRR observations; Attent Specific= attention specific, Loco specific= locomotion specific, Prosocial B.= prosocial behavior, SD vio specific= social distance violation specific, Social B.= social behavior, Sudden obstr.= sudden obstruction , Waiting n-s= waiting in non/sensible area, Waiting s= waiting in sensible area.

Table 2 UMCG ethogram

Behavioral category	Definition[a]
Accommodation	Individual acknowledges that too little space is available, moves to keep distance when someone else comes to close. Individual may adjust posture/position of body in order to provide others with more space.
Attentiveness	Behavior that signal how much attention individual spends on surroundings, and perception and understanding of cues.
Cleaning	Sanitization of hands, cleaning of surfaces, and objects.
Company	Person is in company of one or more individuals. This may be a group of people or pairs of individuals. It is obvious for the observer that they are a group.
Locomotion	Intentionality and speed of walking/movement.
Mask	Mask wearing behavior of individual
Prosocial Behavior	Helping behavior of any sort
Queuing	Standing in queue, waiting in queue
Social Behavior	Behavior displayed by an entity, such as conversing, hugging, sharing a meal. Usually an interaction between two individuals.
Social Distance violation	Violation of the 1.5-meter distance rule to other individuals. These may occur when person is moving or in a static position.

[a] For the elaborate content, see the full coding scheme in Table 3

Table 3 Complete UMCG ethogram

Behavioral Category	Code/Intensity	Description
Accommodation		Person seems to be aware of their surroundings and accommodates in order to give others the space they need to move. Person may step to the side, or provide more room in another manner.
Attentiveness	A1	Person seems to be very aware and attentive to their surroundings.
	A2	Person seems to be slightly less attentive. May listen to music, talks to someone. They still seem aware of what is going on around them.
	A3	Person seems somewhat distracted. May be looking around while also looking at phone or a map.
	A4	Person is clearly distracted and seems consumed by whatever they are doing, not spending any attention to their surroundings.
Hands not free		Person is carrying something, is holding something in their hands. This may hinder them from sanitizing their hands.
Locomotion	L1	Person clearly seems to be in a hurry, needs to get somewhere quickly. Will walk very fast and in a hasty manner demonstrating little patience
	L2	Person walks in a determined manner. Seems to have their destination in mind. Walks in a less hasty manner.
	L3	Person walks purposefully. Person seems to know where to go and does so in an adequate pace. Person is able to accommodate and does not seem impatient.
	L4	Person walks very casually. Does not seems to be in any hurry.
	L5	Person seems to be strolling through the walkways. Slower than casual pace, may seem as though they are taking a walk in the park. Person may seem to have no specific destination they are trying to reach.
	L6	Person seems to be lost. They may walk in different pace and stop abruptly to reorient and assess location. Person may be an obstacle for others.
Mask	M1	Person wears face mask according to the guidelines, i.e. covering their nose, mouth and chin.
	M2	Person wears their mask beneath their nose, still covering mouth and chin.

	M3	Person wears their mask on/below chin, thus, not covering nose or mouth.
	M4	Person is wearing an alternative to a face mask, such as a face shield.
Prosocial Behavior		Person displays any behavior that can be said to be helping behavior. They may push someone in a wheelchair or aid them medically.
Queuing		Person is clearly queuing in front of the information, for example. Person will mostly be static and move only in order to move up after the person in front of them.
Sanitizing		Person is sanitizing their hands upon entering through the entrance. May occur at any place where sanitizers are placed.
Social-distance violation	SD1	Person is walking in one direction while other people come from the other direction, social-distance violation occurs when paths of both parties cross.
	SD2	Person is walking up too closely to someone in front of them. Both seem to walk at the same speed without perceivable intention of person to overtake those in front.
	SD3	Person is violating social distance to people in front during the act of overtaking them. May not keep enough distance to their side.
	SD4	Person is walking past someone who is in a static position, this may be standing still or sitting. Person is walking past them too closely.
	SD5	Person is violating social distance by walking through the queue. This may occur when the queue is long and there is no room within the area. Person thus needs to move through the space between two individuals queuing.
	SD6	Person is violating social distance to those in front of them when queuing.
	SD7	Person is stationary staying too close to someone else. This may occur when person is seated, they may sit down next to someone without 1.5m distance between them.
Social Behavior		This may be an interaction between two people. They may include people eating or drinking together while clearly conversing with each other, respectively the action being one with a social intention.
Unexpected obstruction		Person may encounter an unexpected obstacle while walking along the walkways. This
Waiting		Person is standing, it is clear that they are not queuing, but rather seem to wait for someone or something.

Table 4 UMCG coding-scheme[a]

Code	Description	Example	Recorded as
Date	Identify the date	15.04.2021	Date as presented in calendar
Coder_ID	Identify coder	Bas, Katrin	First name of coder
Pre/Post	Identifies whether intervention is present		Pre (0), post (1)
Start time	Identify start time of recording	12:15	Time as presented on clock
End time	Identify end time of recording	13:45	Time as presented on clock
Density start	Scan the room and make an approximation of the number of people present.	Approximately 25 people moving through space	Integer, e.g. 20,15,
Density end	Scan the room and make an approximation of the number of people present.		Integer, e.g. 20,25
Estimation of queues start	Scan over the number of lanes and people standing in them and record a count	At 14:15 line 1 with 5 people, line 2 with 2 people, etc	
Estimation of queues end	Scan over the number of lanes and people standing in them and record a count		
Sex	Based on the individual's appearance	Male, female, other	No (0), Yes (1), don't know (77), missing (99)
Age	Based on individual's appearance	30, based on visual perception of person	Integer e.g. 20, 35, assigned based on perceived age
In company	Person may be accompanied by other people	Nurse in company of two colleagues	No (0), Yes (1), don't know (77), missing (99)
Hands not free	Person may be carrying folder or phone in their hands	Person is carrying bag	No (0), Yes (1), don't know (77), missing (99)

Behaviors			
Code	Description	Example	Recorded as
Mask	Person is wearing face mask according to the guidelines	1: Person wears face-mask over mouth and nose. 2: covering mouth (underneath nose) 3: on chin, not covering nose or mouth 4: alternative (e.g. face-shield)	No (0), Yes (1), don't know (77), missing (99) If yes (1), then "Mask_specific" 1,2,3, or 4
Social distance violation	Person is not keeping approx. 1.5 meter distance from other people most of the time.	Person is walking past the queue not keeping distance. 1: SD when passing (oncoming traffic); crossing paths with others 2: SD in transit (coming too close to same direction traffic at similar pace) 3: SD when overtaking (same direction traffic) 4: SD stationary obstruction (passing someone who is standing still/sitting) 5: SD breaching queue 6: SD when queuing 7: SD remaining stationary too close to someone else who is also stationary (e.g. sitting down on a bench too close next to someone)	No (0), Yes (1), don't know (77), missing (99) If yes (1), then "SD_specific" 1,2,3, or 4

Total social distance violations	The total number of violations committed by one individual		Integer, e.g. 1,2,3
Accommodation	Person concedes room to keep distance/preventively going out of their way to keep distance/moving out of the way after someone else comes too close	Person wants to take over individual in front of them, the person waits before doing so in order to accommodate others coming from the opposite direction	No (0), Yes (1), don't know (77), missing (99)
Sanitizing	Person sanitizes their hands when entering / exiting the building.		No (0), Yes (1), don't know (77), missing (99)
Hands not free	Person may carry a suitcase/bag or folders.	Carrying something (e.g. bag, coat, food) Busy on phone Holding blind stick	No (0), Yes (1), don't know (77), missing (99)
Waiting (including possibly end/start T)	1: Person is waiting in the waiting (sitting) area (benches) 2: Person is standing still within the observed area. May be waiting for someone	Person sits on the benches.	No (0), Yes (1), don't know (77), missing (99) If yes (1), then
Queuing	Person is standing in line		No (0), Yes (1), don't know (77), missing (99)
Unexpected obstruction	Person may encounter an obstruction that they did not expect and requiring them to change their behavior		No (0), Yes (1), don't know (77), missing (99)
Attentiveness	1: Person seems aware and attentive of the environment and other people. 2: Person seems somewhat attentive, may be distracted 3: Person seems to be distracted at times	1. Person is aware the entire time 2. Person seems preoccupied, in thoughts. Person is having a phone call/listening to music/having a conversation with their walking partner	No (0), Yes (1), don't know (77), missing (99) If yes (1), then "Attive_specific" 1, 2, 3, or 4.

	4: Person clearly signals that they are not attentive to their environment and other people	3. Person seems distracted. Person is sometimes looking at their phone whilst looking around as well/looking for something in their bag whilst trying to keep looking around 4. Person is visually absorbed by phone	
Locomotion	1: in a hurry, appears to be trying to get somewhere quickly 2: purposeful, person knows where they need to go, going there at a normal speed 3: person wanders around, doesn't signal that getting to a destination is a first priority 4: person appears lost, does not seem to know where to go	1: hurrying. Person is clearly late for something or in a hurry. 2: determined. Person may be late. Person is walking determined, 3: purposeful. Person knows where they need to go but does so at normal speed. 4: Casual. Person seems to know where to go but does so in a casual manner. 5: Strolling 6: wandering/lost. Person walks so slow that it is not sure whether they are lost. They may stop at times to re-orientate, possibly being obstruction to others.	No (0), Yes (1), don't know (77), missing (99) If yes (1), then "Loco._specific" 1, 2,3, 4, 5 or 6.
Prosocial Behavior	Code whether the individual carries out any of the following prosocial behaviors Prosocial behavior is defined as any behavior that involves helping, aiding or assisting another	Provide medical assistance Provide help to others. E.g. carrying a bag for someone else.	No (0), Yes (1), don't know (77), missing (99) If yes (1), then description
Social Behavior	Code whether the individual carries out any of the following social behaviors.	Talking to someone Taking a break (eat & drink) with someone	No (0), Yes (1), don't know (77), missing (99)

	Social behavior is defined as any behavior between two organisms, an interaction between the two.	If yes (1), then description

[a.] Variables that were not recorded and coded in the fountain area were sanitization, queuing, hands not free.

Table 5

Descriptive statistics and correlations between variables for the entrance area

	n	*M*	*SD*	(1)	(2)	(3)	(4)	(5)	(6)
(1) Age	637	46.31	17.49						
(2) Gender	821	.449	.497	.145**					
(3) Attent. Spec.	810	1.31	.579	.050	-.016				
(4) Density	617	7.37	4.45	.038	-.043	-.009			
(5) Company	829	.25	.431	.030	-.034	.066	-.029		
(6) SD Violation	824	.53	.499	.175**	-.025	.201**	.0.47	.043	

Note: ** p .001; Attent. Spec. = attention specific

Table 6

Descriptive statistics and correlations between variables for the fountain area

	n	*M*	*SD*	(1)	(2)	(3)	(4)	(5)	(6)
(1) Age	699	48.85	17.54						
(2) Gender	773	.42	.493	.128**					
(3) Attent. Spec.	765	1.35	.632	.182**	-.010				
(4) Density	747	3.00	1.68	-.002	.088**	-.011			
(5) Company	775	.31	.464	.061	-.041	-.075**	.089*		
(6) SD Violation	774	.33	.469	.002	.013	.140**	.265**	-.096**	

Note: ** *p* .001; Attent. Spec. = attention specific

Table 7

Binominal logistic regression predicting social distance violation from age, attentiveness, density, company, and gender in the entrance area

Model	χ2 Model	R^2	B	*95% CI*	SE_B	Wald	*OR*	*p*
Social Distance violation	**	.117						
Intercept			-2.471		.430		.084	.001
Age			.026	[1.015, 1.039]	.006	19.019	1.027	.001
Attention sp.			1.116	[2.016, 4.624]	.212	27.769	3.053	.001
Company			.063	[.668, 1.697]	.238	.069	1.064	.793
Gender			-.147	[.578, 1.289]	.205	.520	.863	.471
Density			.011	[.966, 1.058]	.023	.213	1.011	.644

Note: ** p .001; df (1, 829), B = estimated unstandardized beta; SE_B = Robust standard error; Attention sp = attention specific

Table 8

Binary logistic regression predicting social distance violation from age, attentiveness, density, company, and gender in the fountain area

Model	χ2 Model	R^2	B	*95% CI*	SE_B	Wald	*OR*	*p*
Social Distance violation	**	.109						
Intercept			-2.733		.416		.065	.001
Age			.005	[.995, 1.015]	.005	.944	1.005	.331
Attention sp.			.471	[1.225, 2.096]	.137	11.838	1.602	.001
Company			-.651	[.351, .774]	.202	10.408	.521	.001
Gender			-.043	[.671, 1.366]	.181	.057	.958	.811
Density			.471	[1.35, 1.698]	.058	52.03	1.517	.000

Note: ** p .001; df (1, 829), B = estimated unstandardized beta; SE_B = Robust standard error; Attention sp = attention specific

Appendix A

Loess estimates

Figure 1

Changes in the total number of violations as a function of the start times of observations

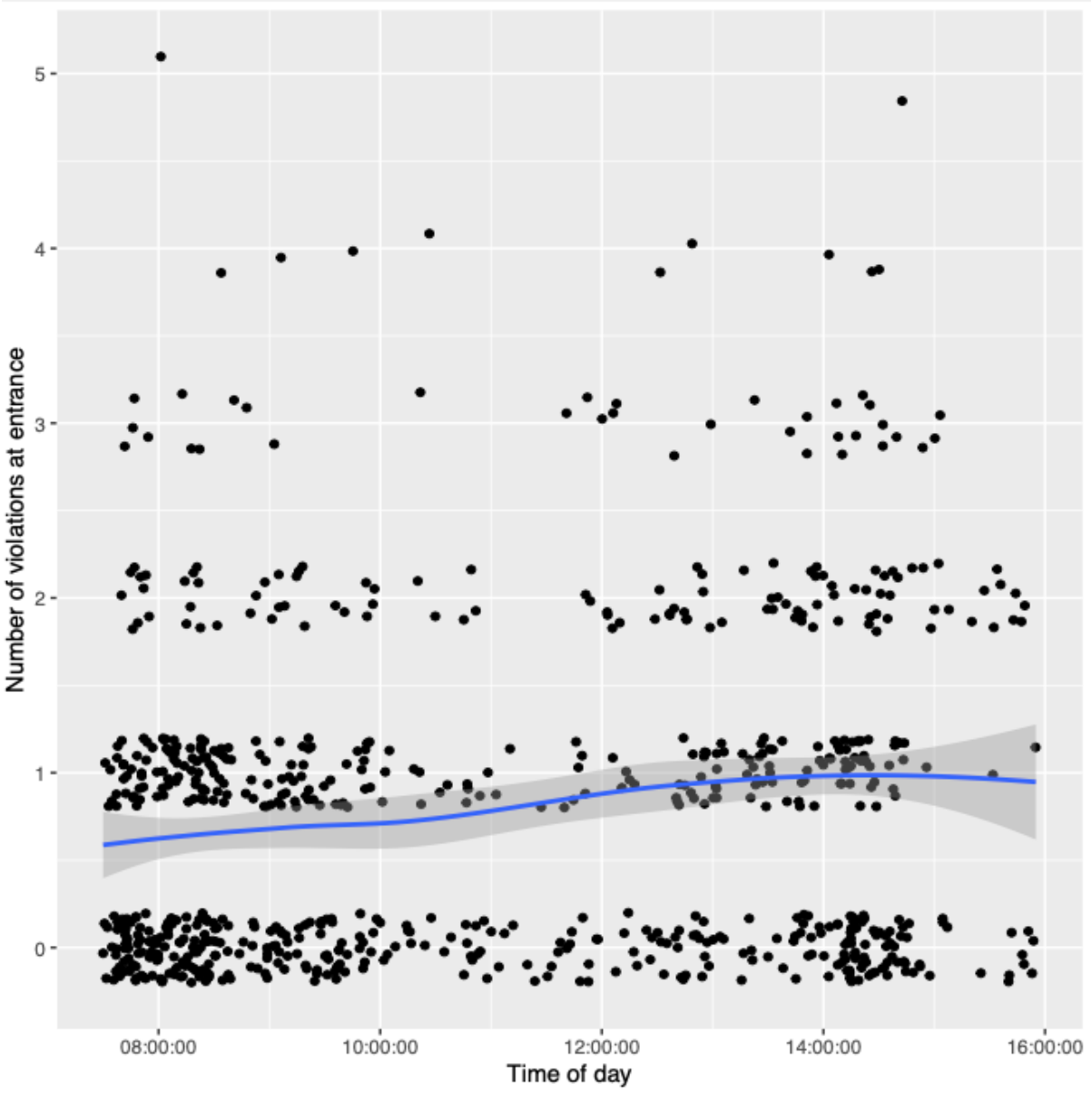


Figure 2

Changes in density as a function of the start time of the observations

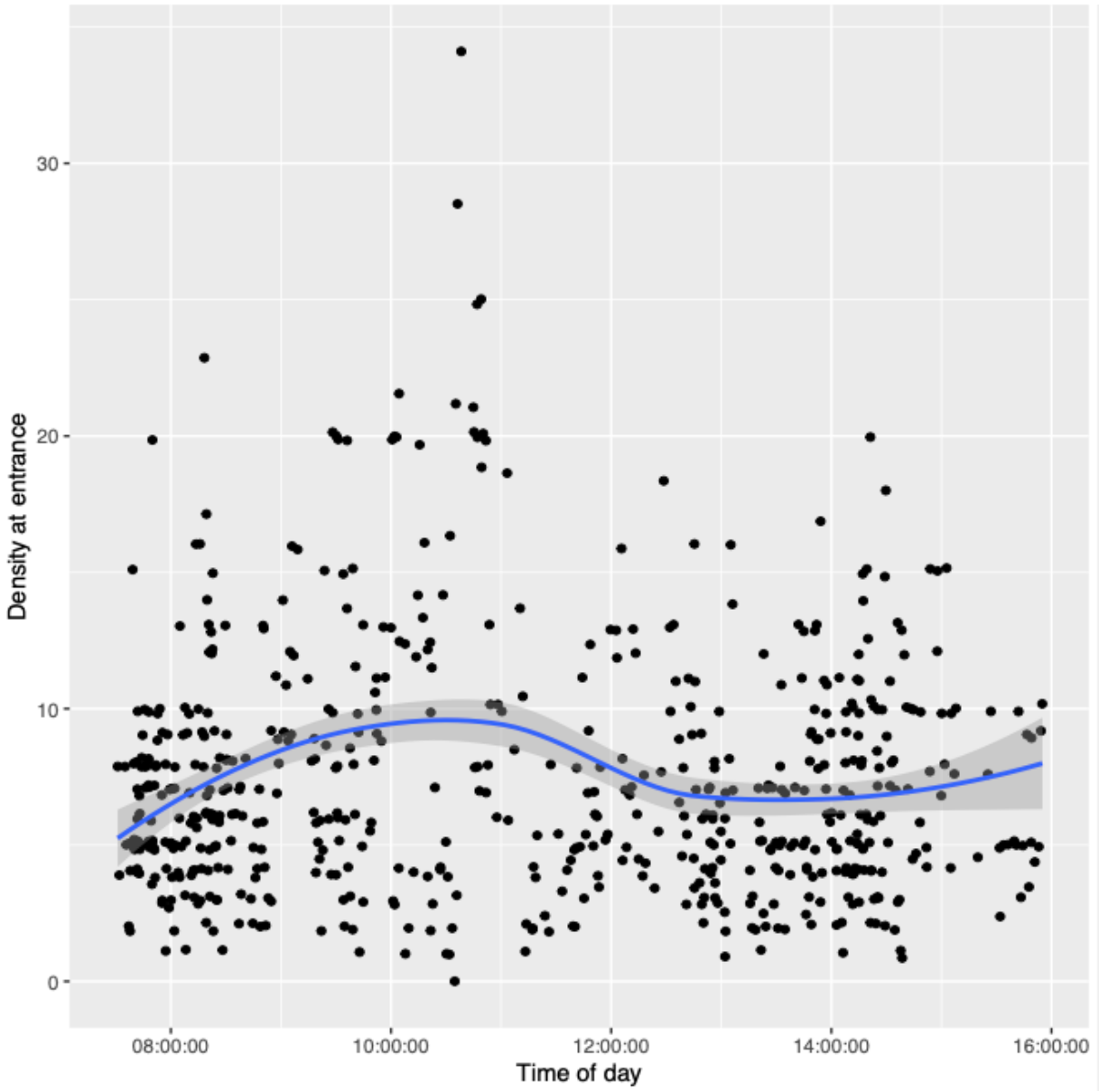


Figure 3

Changes in density as a function of time of observations

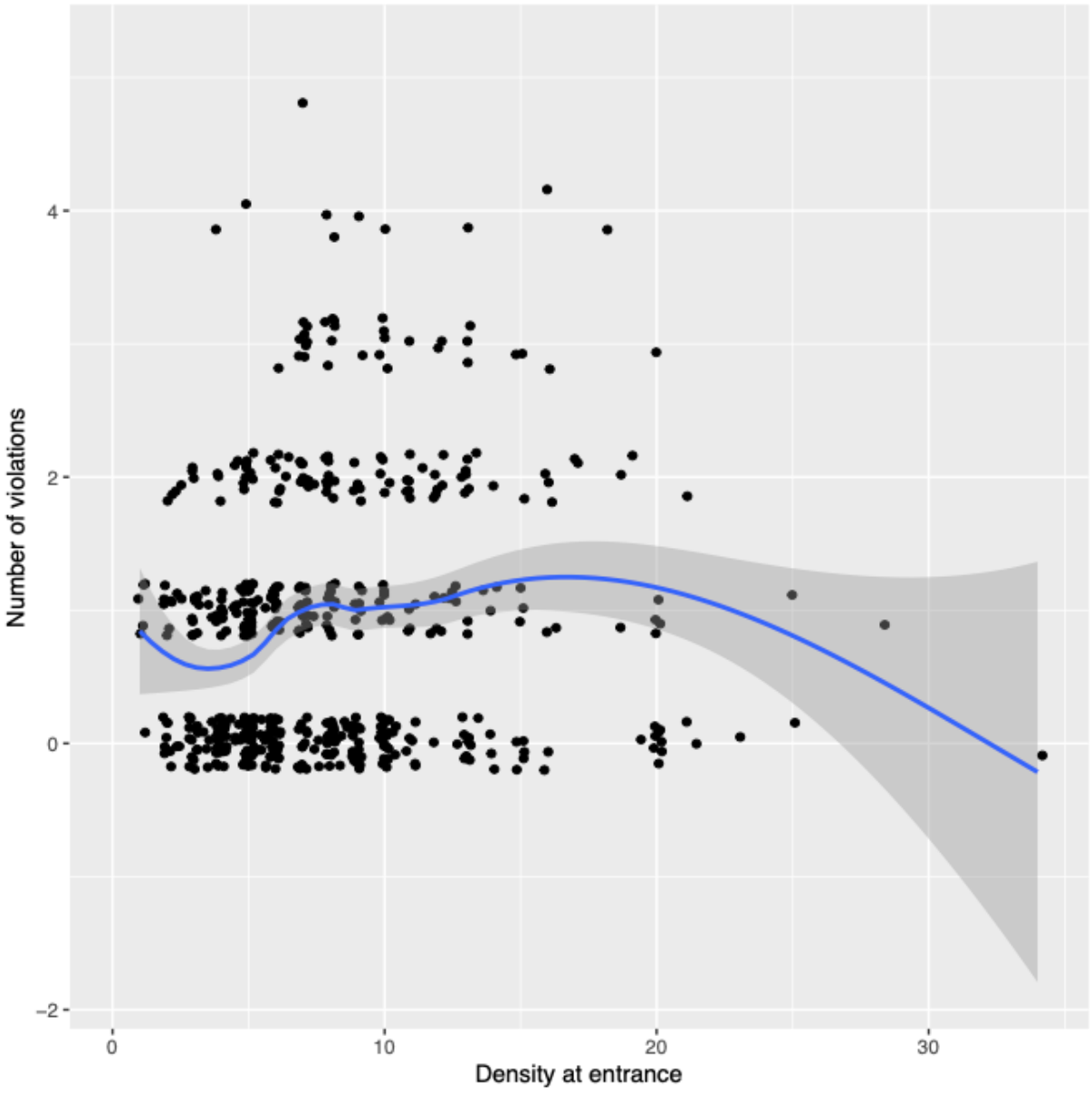


Figure 4

Changes in the total number of violations as a function of the start time of observations

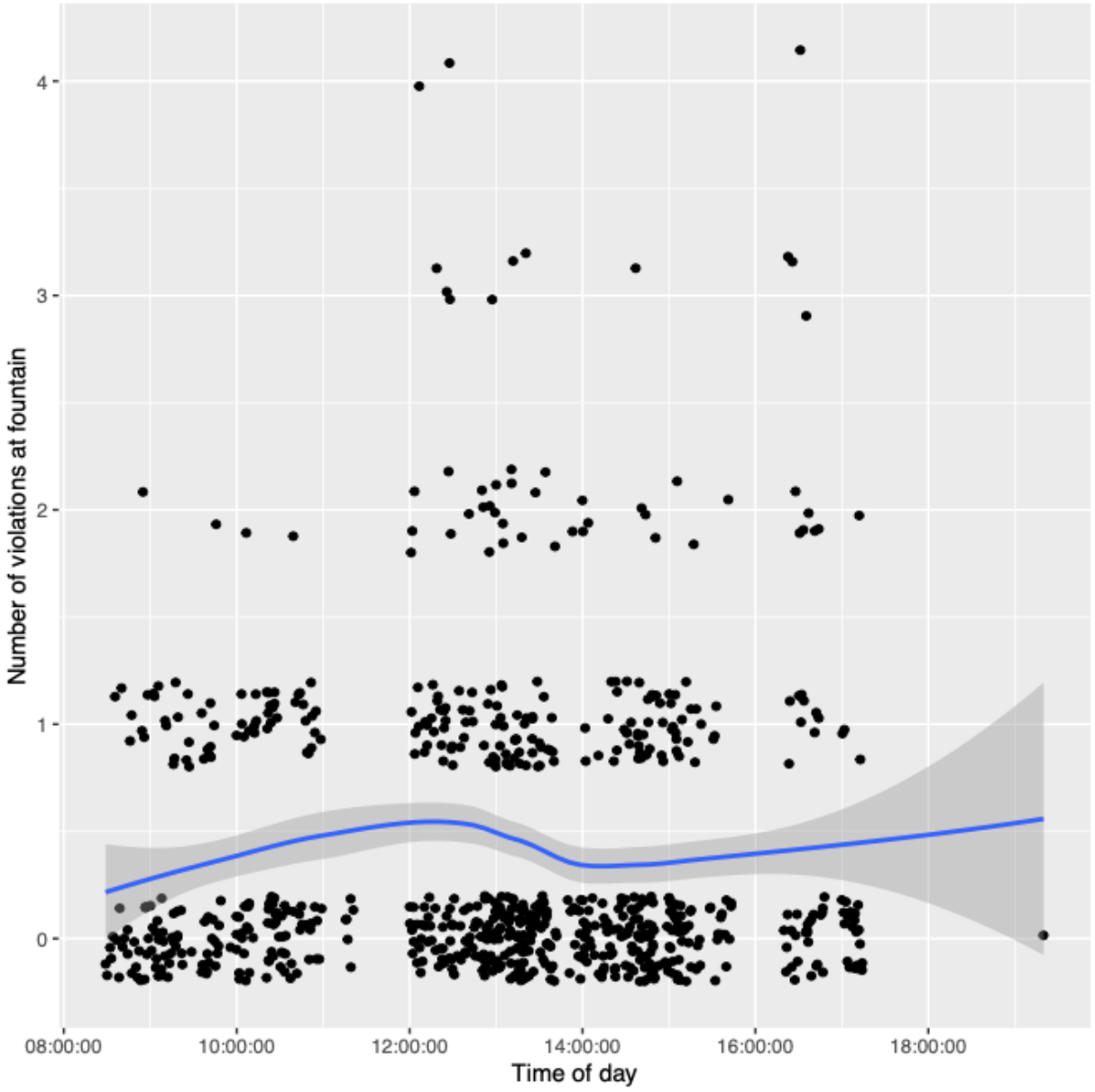


Figure 5

Changes in density as a function of the start time of the observations

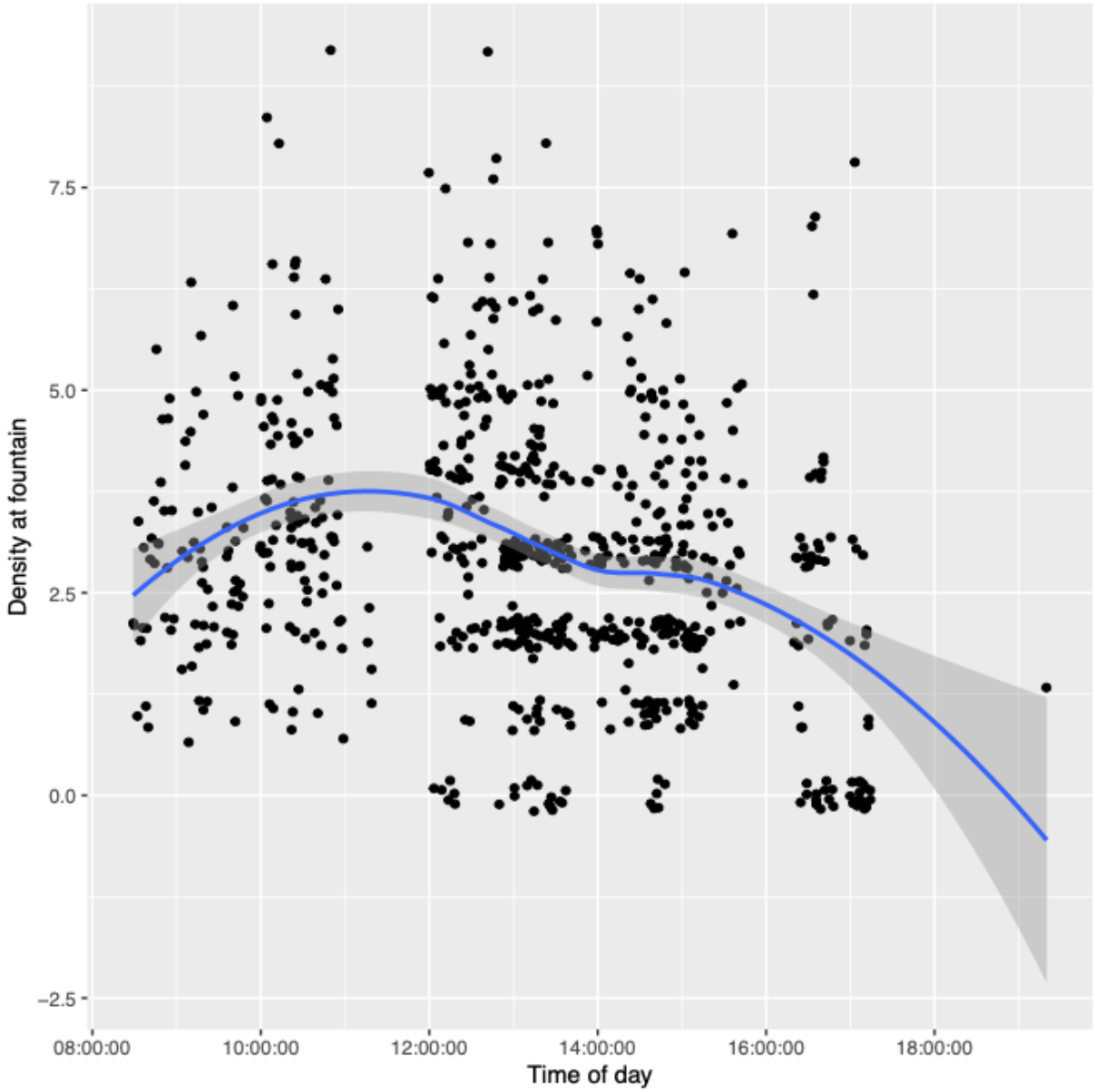
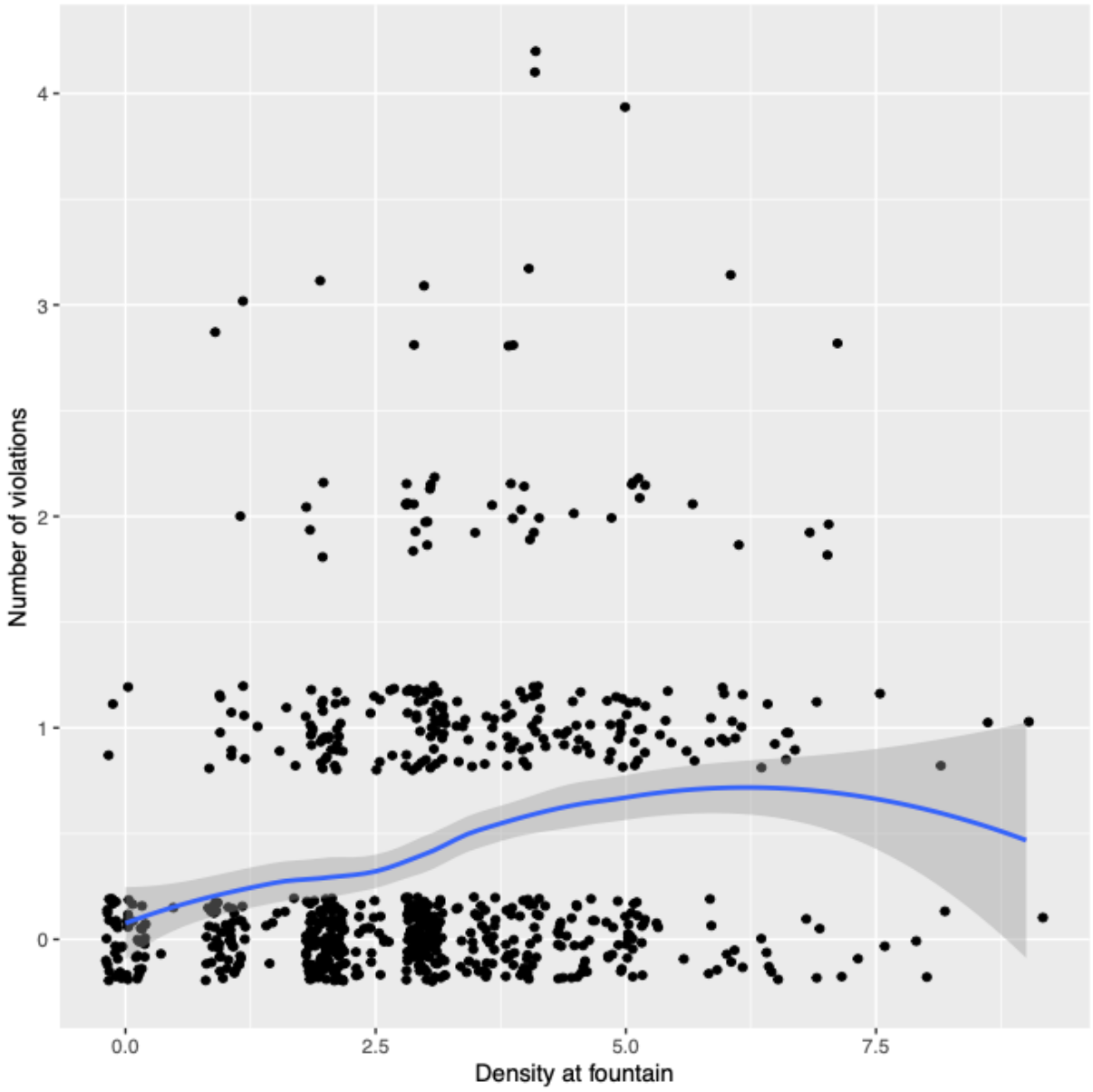


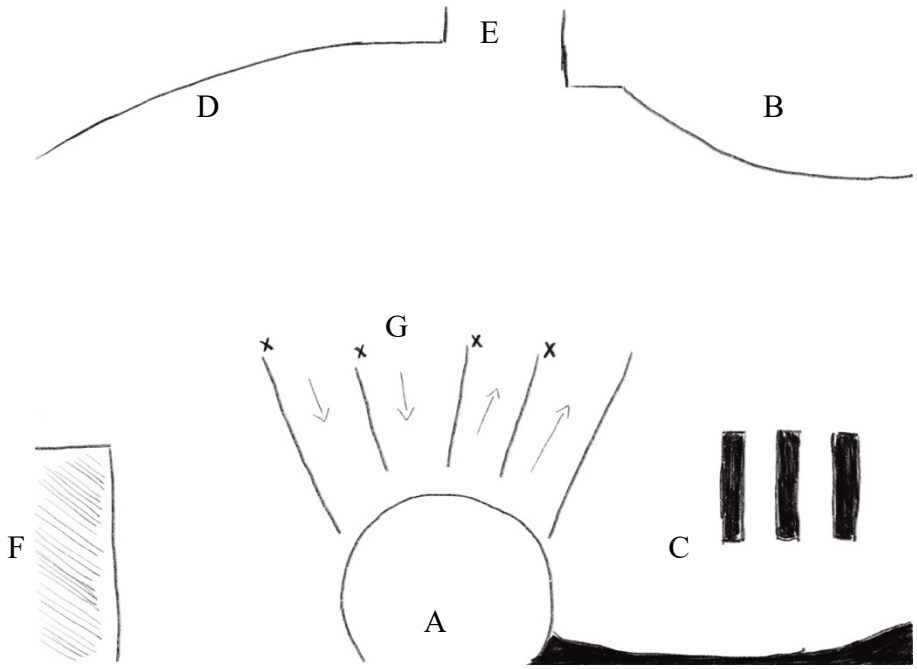
Figure 6

Changes in density as a function of time of observations



Appendix B
Sketch of the main entrance area inside the UMCG

This sketch illustrates the set-up of the main entrance prior to the UMCG in-house intervention.

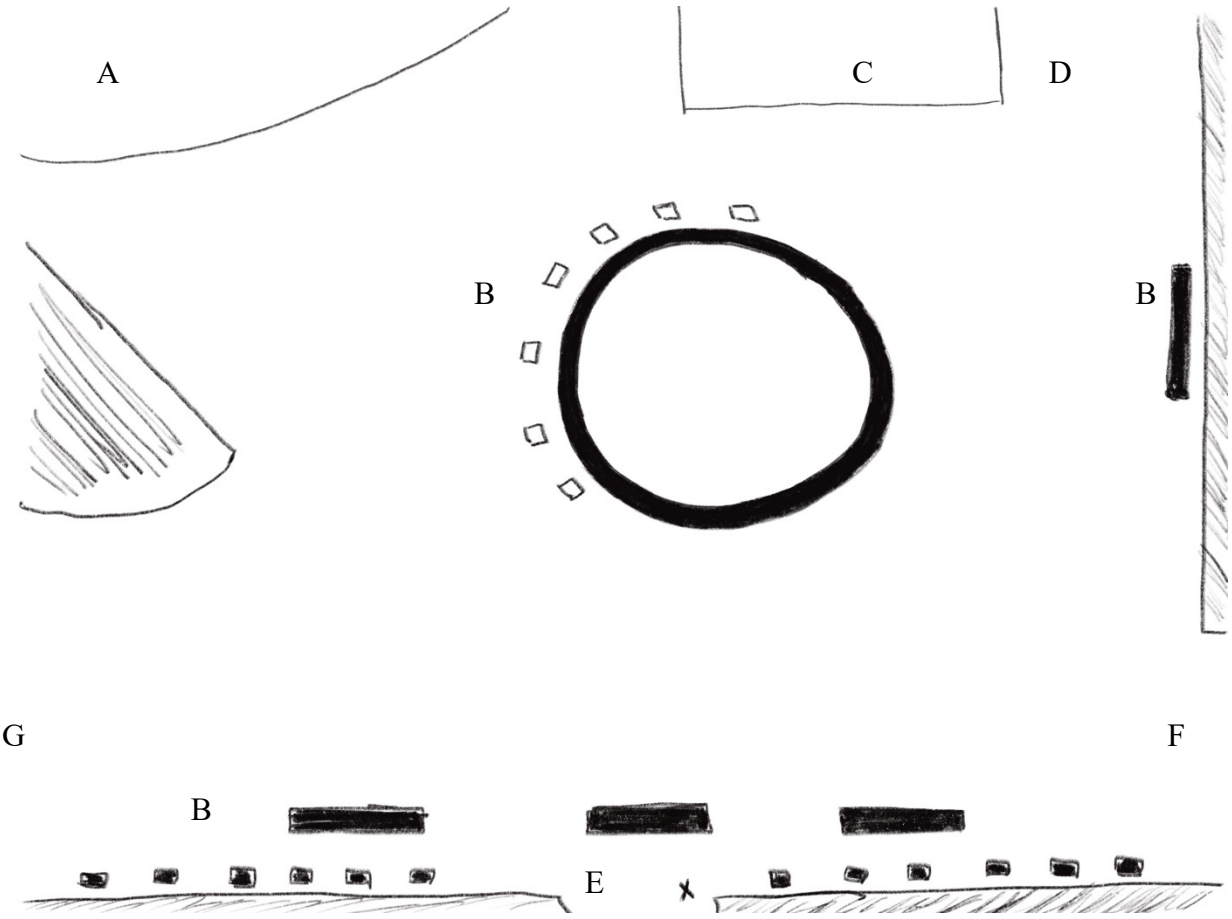


Note. A= revolving doors, B= information desk, C= benches, D= golf-cars and hospitality staff, E= emergency room, F= elevators, staircase towards parking garage, G= hand sanitizers, as denoted by small crosses.

Appendix C

Sketch of the area around the fountain inside the UMCG.

This sketch illustrates the set-up of the area around the fountain. This area also hosts entrances to two policlinics, namely, the radiation and heart & vessels.

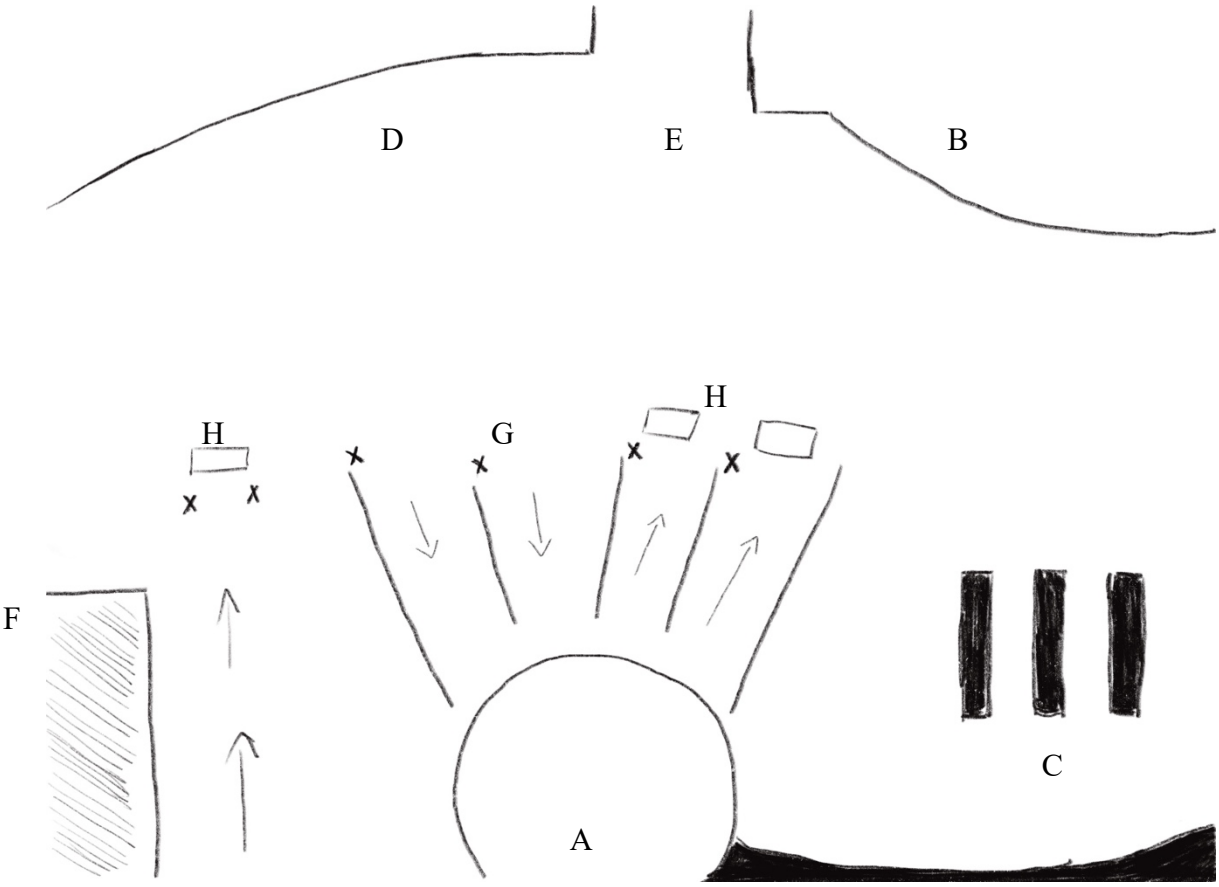


Note. A= food counter, B= benches, tables, and sitting possibilities, C= elevators and staircase, D= policlinic radiation, E= policlinic heart and vessels, F= corridor towards main-entrance, G= corridor towards north entrance and "Winkelstraat".

Appendix D

Sketch of the UMCG in-house intervention

This sketch illustrates the main-entrance with the intervention the UMCG implemented in response to code-yellow.



Note. A= revolving doors, B= information desk, C= benches, D= golf-cars and hospitality staff, E= emergency room, F= elevators, staircase towards parking garage, G= hand sanitizers, as denoted by small crosses, H= table at which stewards were positioned