everybody welcome
uh very much to to our lunch and learn
this month
i'm excited to be the person welcoming
you today um we have some exciting
one health announcements um the first is
that we have a complete seminar schedule
all ready for all of 2021
posted on our website and so if you go
to our website and homepage in the
seminar page you can
get advanced uh exciting warning and
invite your friends
to come to this wonderful lecture series
um we also have a twitter account active
so we are now
ut1 health on twitter all one word i
don't know if capitalization matters on
twitter i suspect not
no excellent people who actually know
about twitter are shaking their heads
that's fantastic
um okay we also have a fun
podcast series that's been launched
already by comedian and science
enthusiast shane moss
um shane has been doing the here we are
uh podcast for a while and has now
started focusing and interviewing our
ut one health scholars and episodes are
available
under our media podcast
path on our one health website um
so yay for attention to ut one health
outreach and communication
and and all of our scholars for
participating in all of our wonderful
guest seminar
speakers uh including today's seminar
speaker dr eric lofgren
um i am very pleased to
to be introducing dr lofgren and i'm
going to read his formal introduction
but also just
as a personal note eric is an awesome
scholar and a really interesting person
and i encourage all of you to reach out
to him after his talk
um all right dr lofgren is an infectious
disease epidemiologist his research
focuses on the uses of mathematical and
computational models of disease
transmission
particularly the transmission of
antimicrobial resistant infections
within and outside healthcare settings
as well as emerging infectious diseases
his work often focuses on producing
policy relevant results

working hand-in-hand with clinicians and
policy makers to produce
reproducible quantitative guidance for
designing and evaluating public health
initiatives
he is currently an assistant professor
at washington state university school
for global animal health
he holds a phd in epidemiology from unc
chapel hill and it is postdoc with the
network dynamics and simulation science
lab at virginia tech
i'm very pleased to welcome him to talk
to us today
about dirty doctors and pestilent
puppies eric
it's all yours all right thank you very
much nida
we'll go ahead and share my screen
hopefully you can all see that so yeah
the the
the title of this talk is dirty doctors
and pestilent puppies and that's really
sort of an encapsulation of what i work
on is i sort of work on infection
control problems
mostly in humans sometimes in animals um
like many modelers i just sort of wander
around
doing whatever interests us at the time
um
and i am at the paul g allen school for
global animal health
which is a mouthful it's going to get a
little smarter uh a little smaller where
we're dropping the animal and we're just
doing global health
uh here pretty soon uh but i i work in
sort of both
areas um and i actually like to start
with an acknowledgement slide
um so a lot of this is done with my
clinical collaborators
dev anderson and rebecca mooring at duke
university and david weber at unc
who is responsible for my interest in
hospital fe at all
um much of this sort of came about um
thinking-wise while i was a postdoc
under stephen eubank at ndssl
the covet in jail work um is a product
of a
large collaboration with nina uh
christian lum at the university of
pennsylvania
aaron horowitz and um brooke i confess i
don't know her last name at the aclu
and kellen myers who's a tusculum um and
then the hard-working graduate students

of my lab
matt kaitlyn and stephanie who are the
folks pictured on the side of the screen
all looking very outdoorsy and so yeah
who am i um i have a phd in epidemiology
from unc chapel hill so i was sort of
trained as
a conventional like let's go estimated
relative risk from a cohort study
epidemiologist
um i did my postdoc at the network
dynamics and simulation science lab
which at the time was at virginia tech
which is a
a group focused on very large sort of
agent-based modeling of um
primarily human social systems and i now
work at wsu
i primarily will work on what i call
policy driven modeling problems so these
are problems where there is
some sort of clinical or policy
stakeholder that needs an answer to
something
um this is what pullman looks like if
you want to live in a place like this
where it is dry and beautiful for most
of the year please do come join us at
wsu
so this talk is sort of a play in three
acts and
um that will touch on sort of parameter
estimation for hospital epidemiology
using
chlorhexidine bathing is sort of a
motivating example uh copenhagen and
incarceration settings and infection
controls and antimicrobial resistance
and companion animals as kind of a
wandering through the work i do and sort
of some of my thoughts on the
global health and one health as an idea
so act one
so hospital fe has some data problems
um and the the sort of the core question
that that
engages me a lot is what if we know
something is going on but our data isn't
great
um this is a problem in hospital epi and
then you go
talk to the poor disease ecologists or
the wildlife disease ecologists in the
room and they go like
you have data and they get really
excited so so this is an
interesting thing where regardless of
who you talk to they're convinced that
they don't have enough data until you

get to like the people who are doing cardiology clinical trials or like we have 300
000 people in each arm we we know everything um so
a lot of examples for this from hospital fee for the work i do
is a single sentence from a paper that is about something else
so a lot of the like parameter estimates and the things i get really interested in papers
are sort of that first sentence of the results section where
people just sort of write down sort of the properties of the cohort they studied and then they get on to what they're actually interested in
but it's that like first sentence that's that's really important for me
um a summary statistic or a set of summary statistics but not the individual
level data when you're working with human data it's often very hard to get that
even when there's not hipaa problems there's you know yeah but we're going to mine this randomized trial for like four more papers before we give it to other people
or information that is on one scale when you need it to be on another so
we know things about hospital wards but we want to know about individual patients in that ward
and i am what to do english medicine lovingly refers to as a data parasite which is i do research on other people's research um
without necessarily paying them for it um
primarily by trying to extract things from the existing literature
so one of the ways we do this is with a method called approximate bayesian computation
which um i primarily like because it works the same way my brain works but it's also a really cool tool
and in its crudest form what you do is you special you specify a prior distribution
for some parameter you're interested in so you say this probability is somewhere between you know 25
and 75 percent likely that's going to be my
prior distribution you draw a

a value from that prior and you throw it
at your model and you simulate your
model a bunch of times
and you say what i want you to do is
tell me whether or not it matches
some summary statistic so an average
number of cases
or the time at which someone gets an
infection
you accept the parameter if the
simulated results are
close to your target by some tolerance
epsilon
and you can use a bunch of clever
techniques like particle filtering or
other algorithms to improve the
computational efficiency of this
but the smaller that epsilon gets you
get closer and closer
to a bayesian prior but if it's greater
than zero this is an approximation of
the prior
um this is really cool because
importantly it's like purely simulation
you have to do
absolutely no math or statistics you
just sort of
chuck computing power at this which is
how all science should be done nina
and why this is useful is theoretically
you have likelihood free inference you
don't have to specify
the likelihood function of your model or
your fit to the data
um this is handy if the likelihood is
very complicated
or tends to not converge well so if
you're using sort of
exotic likelihood functions that don't
converge nicely you can sort of skip
them
or if you simply don't know the
likelihood function um
that you it doesn't it's not well
specified
and acceptance the nice part of the
about this is it can be made
using summary statistics so you can work
on an average or rate something like
that instead of trying to fit to
individual data
you do lose some information when you do
this or you can even do this with sort
of qualitative patterns
which admittedly you use you lose lots
of information when you do that but you
can say things like
i want to make sure my model of bird
migration has the birds leaving at the

right time
and coming back at the right time and
that's often very difficult to constrain
a model that way if you're thinking
about using likelihood-based methods
so that's really nice um graham and
railsbach refer to this as pattern
matching
um and it's a it's a really sort of
interesting approach to things
um this does involve giving up some
information compared to directly fitting
to data
but in many of the cases that i i think
about this has already been done for us
we've already lost the information the
information
cannot be gotten so doing something that
involves a lot of information isn't as
much of a sort of downside
as it as it initially feels like
practically um i find this relatively
straightforward to think about an
implement you can the sort of the basic
algorithm for this is relatively
straightforward to code
and you can sort of double dip when you
work on sort of improving the code for
your simulation engine
it also makes your fitting faster and so
that's that's sort of a nice
bonus as you you sit down to think about
whether or not it's worth trying to make
your simulations faster
is it will make fitting faster too
so my initial reaction to this is like
this can't actually work
this way um but as it turns out this has
actually been something that's been
proposed for a long time so so reuben
proposed the idea of simulated priors
but computing power wasn't there yet and
computing power really is
the the main limiting factor beyond this
everything beyond a toy example
needs some form of a high performance
computing
preferably parallel coding and this is a
major drawback for you know
students in in global health or public
health or or veterinary medicine
i'm saying okay you're going to need a
cluster account as somewhat daunting as
a
as a first step but it is it is an
important one
so we're going to use um chlorhexidine
bathing as sort of a motivating example
of talking about

how we use this and why it's interesting
so chlorhexine if you if you don't know
is a disinfectant with a broad range of
effectiveness it's used
fairly widely in both human medicine and
veterinary medicine if you've ever had
oral surgery and then had a absolutely
disgusting tasting
green mouthwash that was probably
chlorhexidine
and this is commonly used in hospitals
as part of a daily bathing procedure
to reduce hospital-acquired infections
especially in intensive care units
and it's been shown to be effective
separately or as part of a bundle of
interventions in a number of randomized
clinical trials
but in some community studies like one i
was involved in um
with some folks at duke the results have
been somewhat more equivocal
so they found reductions in some
hospital infection
related conditions but not all and
there's a couple different sort of
explanations for this
phenomenon it's there's questions about
whether this was sort of already
improving
infection control standards that
obfuscate the effect of this
um i have some questions about the idea
of facility level
confounding by indication there's
there's definitely some different
constructs there that might work
um so but we're interested in sort of
why those
uh sort of discordant results exist
because whenever you have observational
studies and randomized trials that don't
agree with each other there's
there's interest there and figuring out
why and then the other reason that that
i'm
interested in sort of figuring out how
chlorhexidine works is that in many
sort of intervention studies there's
this end of the sentences like oh and
then also we introduce chlorhexidine
bathing
and they want to attribute all the
effect they see to whatever they
intended to be studying but i want to
know how much of it might be the
chlorhexidine so this is
very common um contact precautions or
sort of a controversial topic

in hospital epidemiology whether or not
you know we should all be wearing gowns
and gloves when we
we contact our patients and there are
groups that have
argued anything from sort of universal
gowning and gloving so
everyone is on contact precautions all
the time to you can get rid of gowning
and gloving for everyone but
patients with active infections and when
these people do these studies it's often
what we you know
we got rid of all the gowns and gloves
and we added chlorhexidine bathing
and then they want to talk about the
effect of getting rid of the ganon
gloves
but what i want to do as a modeler is
sort of disentangle those things to be
able to look at
the effect of both
so this is an example of one of those
sort of equivocal results where
um you have the sort of chlorhexidine
rate is going down already
uh there's a little statistical artifact
um
because of sample size and then it keeps
going down once we've introduced
chlorhexidine but if i was you know the
ceo of a hospital and i looked at this
slope
and then you told me oh it's going to
cost you know a couple hundred thousand
dollars to introduce chlorhexidine
bathing
i'd go i don't i don't know that we need
to do that why don't we just keep doing
whatever we were doing beforehand
so the the question that comes up for
for this study is can we estimate the
per
use effectiveness of fluorexin so
basically when we
you know take a chlorhexidine wipe um
and then we wipe you down
if you're colonized with mrsa what is
the probability that you're no longer
colonized
and this is useful for trying to be able
to understand those differences between
things like a null effect versus an
underpowered study untangling bundled
interventions this is this is sort of
an important number to know but it's
really hard to estimate from empirical
data if you think about how you do this
in reality you'd have to find someone

who's colonized with mrsa
you would have to sort of pick a site on
their skin
bathe that skin with chlorhexidine sorry
sample that site
then pick another site nearby but not so
nearby that the sampling has already
influenced
your your skin flora pick that side
wipe it down with chlorhexidine then
sample that site and you'd have to do
this
while the person was in the intensive
care unit presumably because they're
sick
and so this is very hard to do even in
sort of
academic settings but in community
settings it's a very hard ask
and so it's hard to estimate purely from
empirical data and so the idea was let's
use a mathematical model and approximate
bayesian computation
to estimate this colonization parameter
instead
so this is a three-step process i like
things that come in threes because
it turns out human beings like things
that come in threes so step one
is sort of a pre-intervention fitting of
an icu to some data
so what we have is we have sort of a
meta population model of a hospital
where you have um i believe this one is
18 patients
who are seen by a single dedicated
intensivist and who are all supervised
by six nurses who are assigned primarily
to three specific patients so sort of a
conduit
care um level thing we have another
whole
a home preprint somewhere looking at
what happens when you start poking at
this structure but this is the structure
we use for this
and so what we're fitting the the icu
data to
is there's one free parameter in our
model that's how we sort of calibrate to
the experience of real hospitals
and this is the probability of
successful colonization of an
uncolonized patient
due to contact with a contaminated
healthcare worker so basically
this is if a nurse or doctor has mrsa on
their hands
and they touch you what's the likelihood

that you get colonized from that contact
and what we fit this to is there was a
study the benefits of universal gowning
gloving or bug study that had a very
very
detailed um sort of rate
calculation for their pre-intervention
colonization rate in their hospitals and
so we have that as sort of
one of the best what is the infection
rate in an icu before you do anything
um infection rates so that's what we we
fit this to
we also there is a very slow spontaneous
decolonization rate that's been observed
in some other studies
we put that in and yeah we use this
stochastic meta population model of an
icu
i'll prevent i'll present a more
simplified diagram of this later because
essentially
trying to show all the compartments for
this model in a figure starts to break
down very quickly
and from here what we essentially do is
we simulate a series of interrupted time
series studies
to try to get at this question so what
we're fitting in this model
is this blue line and this is if anyone
works in mosquito control and you're
like this looks
a lot like a ross mcdonald model that's
because it is
so what we have is we have s which is
uncontaminated staff
and we have h which is staff that have
contamination on their hands their
bodies something like that
and contaminated healthcare workers
can contaminate uncolonized patients so
that's those people in you
those people and you then go from u to c
and they're colonized
and then they can contaminate the hands
of uncontaminated staff so that's how
you move from s to h
so the important part of this model is
that the patients aren't giving each
other infections
we're assuming everyone's in a single
room otherwise you're otherwise
you've got good infection control
policies there's no environmental
contamination things like that
and so really it's just this
contamination question
is what's driving infection and the

first thing we're fitting is this blue
line
and that's what gives us the rate that a
real icu sees
the next step is to add chlorhexidine
bathing so this is to estimate the
probability that chlorhexidine bath
results in full decolonization
and here um this is where i mentioned
you know you can steal summary
statistics
there's a very thorough meta-analysis um
from the general political
journal of critical care in 2016
that estimates an um incidence rate
ratio of 0.75 basically so 25
reduction and the question we're asking
is what value of the parameter we want
to fit would result
in that corresponding decrease of cases
so this is a picture of those particular
studies
um the table isn't really important
except you'll note we're leaving three
studies out we'll get to those three
studies in a moment
and so we're fitting essentially this
green line here now is
is the line we're looking at which is
the perimeter of you going back from
colonized to uncolonized
now there's a step three which is new
pearson so mu pearson is a nasal
um decontamination process
that often takes place alongside
fluorescein for full decolonization
staff lives very happily in your nose
and so even if we decolonize your skin
it's possible you will then touch your
nose and recolonize yourself
so we need to essentially get up in
there and kill everything in there too
and several large studies have included
both that same meta-analysis essentially
said for those studies you have an
incident rate ratio
of 0.578 so basically 0.58
and so there's an additional reduction
in the studies scene
that use me purisin and so we need to
now estimate both of these effects
note that this does assume the effect of
these two treatments is additive so
you know you can you could do one you
could do other you could do both the
both is just the effect of one plus the
other we've started to look at what
happens if you sort of relax that
additive assumption but that

the answer is the math gets much much harder and so that's these
um three studies that we left out and the important one is this
study by susan huang which is why we wanted to include this
is because there's about a hundred thousand individuals in each arm of the study
this is most of the data we have about chlorhexidine
is contained in this single massive randomized trial
so throwing that out because they also included mupirasen is kind of a problem
so that that's why we included that study and and sort of added this comparison component
so now we have basically a new purple arrow along with the gray narrow
again getting you back from colonized to uncolonized
so the caveats and assumptions to this are because
all models have caveats and assumptions is we assume random mixing within the patients that the nurse
sees so you they sort of bounce between their three patients
and then random mixing between patients and the intensivists
we're only examining chlorhexidine's effect on decolonization
so the idea here is that chlorhexidine reduces colonization pressure by decolonizing potential infection sources
but it's not self-protective if we give you a chlorhexidine bath
you're not equipped with like immersive deflector shield uh we've
looked at the effect in another study of of
that sort of deflector shield idea and the answer is that it's okay
um we also assume there's an instant detection of acquisition so
you know we we find and know perfectly whether or not you have mrsa and we're sort of counting things appropriately
we relax this assumption in some of the results i'll show and add a latent period
of between one and four days where you're colonized but we don't know it yet
and that sort of changes the answers but not much colonization is an all or nothing process in this you are either colonized or you're not

there's no like uh it's growing but it's
it's not quite there yet
everyone is treated so for simplicity
everyone gets a chlorhexidine bath every
day
and the other one and this is sort of
for the observational epidemiologist in
the room
there's an assumption that the mix of
interrupted time series and randomized
clinical trial study designs
that are included in this meta-analysis
are both capable of estimating an
unbiased effect
so essentially neither group is is
somehow systematically wrong
and we can just take their data as is
and use it
so the results we get from this are the
the figures on the left are
uh chlorhexidine and pearson the figures
on the right or when we add that latent
period
um and the answer is the per sort of
application efficacy which is this
median line
is about 18 for both if you assume we
know perfect
um sort of detection and about 15
if we don't so this actually came as a
surprise to me because this means this
isn't actually very good at what it's
supposed to do
you know we bathe you once and there's a
less than 20 percent chance that you're
now
clean um that's a little bit worrisome
given we
do this to people in the icu all the
time but what it turns out is is that if
you just do this
a lot it works really well
because one of the things that we had
also been asked on by clinician
is can i space out the timing of bathing
for chlorhexidine
chlorhexidine is associated with skinny
irritation in adults
and it's associated with neurotoxicity
in infants
so there's definitely an interest in
like could we only do this occasionally
and still get something out of it and so
we varied this from sort of
this baseline which is we never do this
to 24 or 48 and all the way up to sort
of five days
you know you get a a bath once every
business week

and the answer is you still get benefits
from this so essentially
if you apply an okay intervention a lot
even if that a lot is is less frequent
than you otherwise would
you still get benefits from this which i
think is sort of an important
um message and the takeaways that you
that we we got from this study are that
the per use effectiveness of
and comparison is surprisingly low
but there is a sort of caveat to that
which is these estimates
are they're not lab estimates they're
effectiveness not efficacy
so they're both based on the actual
chemical action and importantly the
application
and i think the application is where we
as a field sort of have some weaknesses
that we can improve on
for example chlorhexidine um there are
many sort of apocryphal
stories about nurses adding a
um soap to chlorhexidine because
chlorhexidine isn't a surfactant when
you wash someone with it it doesn't
produce
suds and people want to see sort of suds
when they're where they're going through
bathing
the problem with that is soap
deactivates chlorhexidine
so if you add soap to chlorexidine to
bake studs
what you've done is you've made bubbles
but not chlorhexidine anymore
and so that's sort of a problem and then
similarly for um mu pearson i
i went to a talk with susan huang she
described the
process of decolonizing someone with me
pearson in her study
and it's essentially a nurse sticks a
swab with me pearson up your nose
sort of rubs it around in a circular
motion for two or three minutes
and then does your other nostril um
this sounds like possibly the most
awkward thing i have ever heard
and so my question is is that is that
what's actually happening in these
studies
or is everybody doing what probably
happens which is you just sort of get
both nostrils you sort of
go around for a bit and then you're done
and is that enough application time for
me pearson things like that

um so that's that's the real question we have is is how much of this is application
but there's room to move the needle there this is not sort of these 25 percent
or sort of 40 decreases in infections that we're seeing in hospital units
this isn't the cap of how well decolonization can do
there's there's room for more there and the good news is that some flexibility application frequency still has a positive effect
um if you're really interested in going into detail on this this did finally get published in gemma network open
um the url is down below it's trivially easy to find by
typing in jama network open lofgren there's only two papers there
so act two we're going to shift gears entirely and we're going to talk about covet a little bit because i'm sure everyone is not yet tired of hearing about cobit work
and so we wanted to look at covet 19 in jails
covet 19 has been a huge problem in jails prisons and detention centers
for reasons that i don't think requires sort of particularly brilliant epidemiology you have
lots of people in close quarters with not particularly good access to hygiene
no real infection control no real social distancing
and highly shared environments so we were particularly concerned that essentially
we're preserving this one setting with potential for super spreading
because it's sort of socially and politically uncomfortable to talk about you know
we have closed movie theaters we've closed schools um
wsu sent all our our students home for for the semester and then like but jails do we still need to deal with those and it turns out the answer is yes
and so this modeling work that we were looking at here was looking at intervention interventions to try to reduce coven 19 in jails
um doing work with both university and ngo collaborators in this case on the aclu
who were really helpful in sort of

informing what was feasible
interventions
and helping with immensely with
parameters i'm not an expert in
incarceration um
i hadn't ever sort of worked in jail
settings before so they were useful both
for you know putting us in contact with
experts who could say things like
yes this is how a jail works no this is
not how a jail works you know you just
saw that on tv
and also feasible interventions on sort
of both sides of things things that
you can't do that because that's sort of
a violation of someone's constitutional
rights
or also we shouldn't spend a lot of time
talking about this intervention
because that's not politically feasible
it's never going to happen so
what we did is we modeled a largely
idealized system a city at the start of
its coven-19 outbreak doing everything
otherwise
well so they have a social distancing
and sort of work from home order
and people are complying with it and
most of the parameters here are drawn
from allegheny county pennsylvania
due to a particularly detailed amount of
public data about their jail
um expressly this means it will not
predict a single city or jail
despite an immense desire from people to
have it do that
we can't sort of plug in knoxville's
numbers or los angeles numbers and like
turn the crank and tell you how many gel
cases you're going to have
it's not meant for that it's an
idealized system
and so what we do here is we model the
jail and community sort of interface
and the fact that jails are highly
connected to their communities
jails are essentially short-term um
facilities
most people are intended to return to
their um
community they often do so very very
quickly
and so we essentially have is another
meta population model
where in the community we have children
adults for three categories low risk
high risk and elderly
and then the jail staff and they cycle
between these categories the children in

our model can't be arrested
so the jail staff um move to the jail
and stay there for eight hours and then
go home
and the low-risk um high-risk and
elderly adults can be arrested
they go to a um a different sort of
population which is processing in court
this is you know your court dates um
being processed to get put in jail
being processed to get taken out of jail
things like that and then put in jail
itself and then
they can cycle back to the community
what we see when we do this is a
phenomenon we call carceral
amplification
which is this idea that because we have
this highly connected
very sort of powerful source of
infection in the community
uh sorry in the jail both you see a very
large
spike in cases in the jail that happens
before the community
but then this will also feed cases into
the community
and so essentially you have this engine
that's driving infection transmission
and you get a very scary epidemic curve
for the jail itself
which unfortunately we did see some very
scary epidemic curves for jails in this
particular outbreak
um and we looked at a lot of different
potential questions the first
one i'm presenting here is sort of this
question of well could we just do social
distancing can we you know
we can we space prisoners out can we
give them soap and will that you know
work and the answer is that even when
you get to
the equivalent of a population
sheltering in place
well that would certainly help you still
get a very large spike
and in the community it mostly just
delays the epidemic
and in the jail it slightly reduces the
magnitude of the epidemic and delays it
but you still have a very large sort of
epidemic so it's not enough
to just spread people out which is what
i think um
some facilities we're hoping for is we
can just do social distancing and we'll
be fine
so then we looked at some other

scenarios looking at things
like um arrest reduction so this is
essentially
um sheriff's departments and things like
that using some discretion to say look
we're not going to arrest you we're not
going to send you to jail
here's your court date you better show
up on that court date
um and we looked at a number of
different scenarios for this so the dark
blue line is what happens if the
community
as a whole is just sheltering in place
but we don't do that and then we sort of
step through progressively more extreme
versions of bail reduction
uh sorry arrest rejection the first one
is bail eligible
if we think we're eligi if you're
eligible for bail we're just not going
to charge you for bail and send you home
this one is a pretty easy one to justify
it's essentially like
we're just not gonna make you write a
check but we otherwise think that yes
you can be in the community you're
eligible for bail
um the salmon line is what if we send
vulnerable people home so we look at you
and we say
you know you meet some of the criteria
for people who are vulnerable to
copenhagen so you're elderly you have
lots of sort of comorbidities
surrounding your your cardiac system
things like that
what if we don't arrest you um the sort
of
pale blue line is low level offenses so
this is
offenses against property not people
what if we send those folks home we say
okay don't do that again but like
we're not really worried about you being
a threat to other people
and the final one is just what if we
just arrested fewer people we just say
like across the board arrest fewer
people
and what we see is that in each one of
these essentially the more people you
choose not to arrest and send to jail
the better your health outcomes are so
you have huge reductions
in the incarcerated population but you
also see fairly substantial reductions
in in
both infections hospitalizations and

death in the community
and even in staff which admittedly is
sort of the hardest
needle to move in this is is infections
among among staff
so the takeaway we we have from this is
that copper 19 in jail
is a threat to both the jail itself and
the surrounding community and these two
systems
are very tightly linked and because
jails are inherently very permeable
settings
most people are there for short stays a
lot of those people are only there for a
day or two
which is just enough time to get coveted
and then return to your community and
get everyone you live with sick
um some control efforts may be
detrimental if they discourage case
finding
so i didn't show that in in this one but
essentially
if you punish reporting that you're sick
which
some jails did sort of implicitly do by
turning their
um isolation war isolation cells into
quarantine wards
which is not a very pleasant place to be
quarantined
that discourages case finding and that
encourages people to wait until they're
obviously ill
which is extremely detrimental to sort
of all
infection control processes increasing
distancing helps
but it doesn't fully resolve the problem
and importantly that's impossible in
crowded scales
so if if your jail is already at
capacity social distancing isn't really
something you can do
and so decarcerization efforts are
important both for
being more effective themselves and to
enable that increased social distancing
for those who must remain in jail if
there are individuals who we say
look this person does just have to be in
jail
the less people who don't have to be in
jail the easier it is to keep them
um socially distanced and um from
getting sick
so acts 3 the final act of this is the
role of companion animals in infection

control
and antimicrobial resistance so
infection control and antimicrobial
resistance and veterinary populations
and settings is very similar to in human
settings
but you have less money and your
patients can't talk
and it turns out both of those things
are actually really really big
challenges to infection control
in for example veterinary teaching
hospitals which wsu's is this
this lovely building um on the the
right-hand side of the screen which is
about
10 feet away from where i work and one
goal of my group is to examine infection
control in these settings
and this is largely in higher uh
inspired by klebsiella pneumonia
outbreak
at the wsu veterinary teaching hospital
where this is a pulse fuel gel of
essentially there was an outbreak of
klebsiella
in 2009 all the way to 2011
that was pernicious and very hard to
deal with and but then we we dealt with
it was 2011 we were finished
and then in 2016 a dog shows up
with a strain of kleps yellow that is
smack dab in the middle of the outbreak
strain
um and it's five years later and this is
a little bit confusing
and so the question is sort of but where
does the klebsiella come from
um somewhere in pullman there is a chain
of klebsiella and ammonia transmission
that gave this dog
essentially an outbreak strain five
years later is this in humans
like is this just like there are some
elderly people and their dogs
who are just passing klebsiella between
each other um
is this only in animals is there some
sort of disgusting little puddle in the
vegetarian teaching hospital that just
has klebsiella living in it and we we
haven't found it yet or is it in you
know both
does the hospital know so does pullman
regionals see cases of klebsiella and
ammonia
um we still don't know the answer to
that i do need to get around to finding
that out

and then the the question that sort of comes around with that is what if you could combine infection control for human and veterinary populations what if these two groups of people talked to each other used their surveillance data accordingly and and sort of looked at this question and so since i'm a modeler the answer to this is what if we just build a utopia where this happens um so what we decided to do was build what's called the synthetic population of pet ownership so this is a virtual population of people who own pets and their pets go to hospitals and they go to hospitals and we we watch what happens lots of synthetic populations which have been used in epidemiology there's been a lot of them used for 19 are constructed for fleeting transients and largely indirect contact so in fairness this is because they were designed mostly to model influenza where this makes perfect sense you know you can sneeze on someone and get them sick for looking at something like mrsa or a antimicrobial resistant e coli we need something that's built on more direct sustained contact um we need something where you know touch in a shared environment is a much more important thing and ideally um from sort of a project perspective this would be suited for modeling as a standalone network or a sort of a synthetic catchment population for looking at um community transmission for both veterinary or human hospitals and would also be nice not to reinvent the wheel so we did is we stole a model from some colleagues of mine uh christian lum um samar swarup stephen eurank and james howden um who were looking at um incarceration and using an agent-based model of racial disparities in incarceration rates and importantly what they do is they create a synthetic population that builds affinities based on proximity so essentially they scatter people on a one by one grid and they say you you know make friends you meet your future life

partner etc based largely on the people
who are near you
and there's lots of ways to
conceptualize this space you can think
about this as geography
you're more likely to sort of meet and
be friends with someone who lives near
you then far away
this can be affinity so this can be you
know you agree on two different axes of
some belief
etc and there's a pairing process agents
have children based on population
distributions etc
and at the end of this you get a
synthetic population with parent sibling
spouse and close friend relationships
which we said are the kinds of
relationships
where you can foresee sort of immersive
transmission occurring where there's
that
level of durate um direct sustained
contact
so this is what this ends up looking
like you get a legitimate sort of family
tree
and this is that one by one sort of
affinity space once you run a clustering
algorithm on it
and you can see that there's you know
distinct groups of people you have
communities
and so this is sort of what we're going
for and so our extension of this model
is to add pets um
the first version will likely just have
dogs and we're working on that now
built primarily on national level
statistics where we can and then sort of
collapsing down to pullman level
statistics we're not
primarily as a zero-inflated poisson
model where we say you know you have
probability of either owning dogs or not
owning dogs
and then for those who own dogs we draw
how many dogs you own from distribution
in my case that answer is three one of
them is is felix here
and at the moment we're not modeling
animal animal contact so we're not
modeling
for example doggy daycare although we
are interested in this and one of the
questions we are interested in is
modeling the type of ownership
so for example felix here is sleeping on
a chair this is the same chair i

normally eat dinner in
so there's definitely a potential
microbiome interaction there
whereas someone who has an outdoor
hunting dog
that relationship is probably much less
sort of intensive
this work is ongoing but one of the
questions is like okay but but why
add this besides that you know i can put
cute dogs on slides
and one of the answers to that is we've
actually seen coveting companion animals
so in a study we did sampling 67 dogs in
46 cove 19 positive households
um we had clinical signs in about a
quarter of those dogs
and 43 of them were antibody positive
but all of them were um pcr negative
when we did nasopharyngeal swabs
so they sort of got covered but they
didn't they weren't good at shedding it
so it's pop
it's likely that sort of the people gave
the pets coveted
um and there was a weak association with
some sort of behaviors that would make
sense
um so if you share a bed with your dog
or the number of humans with covenant in
the household
those were both sort of things that were
associated with a higher risk in the
dogs
there's also a novel coronavirus
currently emerging among domestic dogs
in malaysia right now
suggesting that we should also be
focusing on domestic animals in addition
to one health's
often very wildlife and
livestock-centric approach
essentially because companion animals
have very high contact rates
there's similar antibiotic usage
patterns for example a lot of dogs when
they're treated for antimicrobial
sorry antibiotic sort of susceptible
infections get
people drugs and um so there's there's
sort of a
question there with drug usage patterns
and so there's there's
there's room for looking at companion
animals as a potential source
for either transmitting disease or just
carrying it along with them as fomites
so you know
if you have mrsa you pet your dog's ears

your dog is not very likely to get mrsa
it is however likely to carry that mrsa
on their ears for a while
you know you get treated and then you
come back and you pet your dog's ears
again and you've just recolonized
yourself
so we have some other work in that area
um
working with a vet student here
distinguishing human human human animal
and animal animal transmission in
hospital settings
so essentially trying to look at a
veterinary school and say okay
who's giving who what um direct
observation of staff using contact
patterns in veterinary teaching
hospitals so
getting some of the same parameters we
have for hospitals for veterinary
teaching hospitals
obviously this is on hold for covid
because as it turns out i'm going to
have a bunch of undergrads follow a
bunch of clinicians around
it's a terrible idea in the middle of a
pandemic um we're also working on some
social contact surveys of pacific
islander populations
in both washington state and arkansas
and currently working on a contact diary
survey
of wsu staff and faculty to try to
figure out if there are particular
groups who who did or did not
sort of successfully reduce their
contact rate um
while working sort of with our our
particular version of work from home
so thank you all very much for your
attention uh my contact information if
you're interested in talking to me
is eric.lofgren wsu.edu i am on twitter
at
germs and numbers and i'm hiring at
least one postdoc
so um feel free to reach out and a lot
of this work has been funded by the
modeling infectious diseases and
healthcare program or
um we have a contract with the cdc
looking at this in healthcare
or we have a national science foundation
rapid grant to look at covet 19 as well
um and yeah thank you all very much for
your time and attention
thank you so much um uh
internet clapping um i so i think we

have time for some questions i don't
know do you want people to unmute do you
want that to be a curated
question experience how would you like
to handle questions
um i am happy with any of those
approaches
um dealer's choice
all right so let's let's try it and
unmute and go for it and if it becomes
madness i will start arbitrating
anyone have questions feel free to add
me
here i'll i'll start with the last last
one point i made in the chat very
interesting thank you
um you said the estimated efficacy of of
of bathing
the the the the individuals uh was
surprisingly low but isn't that what
clinical
trials have shown so the clinical trials
show
that the the sort of reduction in
overall sort of ward level infections
were somewhere between about 25 and 40
percent
and so i think everyone everyone is
imagining
when we do things that we do believe are
very effective we also get those sort of
same numbers
um basically a lot of sort of
the aspirational sort of infection
control um reduction is about 25
and so i think what it is is that we
sort of perceive chlorhexidine is this
very powerful
tool and i think that carries along with
sort of an intuition that it should work
really well
but you're right it doesn't it doesn't
have to it doesn't imply that it does
that especially when you think about
how often it's applied that you can you
know if you just do this a lot and it's
just okay
you get a reduction that is just okay
um but i think a lot of people
clinically and and from from talking to
clinicians
this seems to be surprising to people i
think a lot of people are expecting
chlorhexidine
to be much more effective on sort of a
per-use basis
okay well but i mean again it seems like
the procedure is still 25
so why would you expect it is more

efficient but okay yeah
um i think it's that people imagine that
there's a lot of other sort of pathways
that you can you can get infections
through
sure um but yeah i think it's i think
it's fair it's just sort of
reflecting on people's reaction to this
this work because
i've ended up sort of presenting
versions of this over the past four or
five years one person who is not
surprised
so now you can correct it well that's
excellent
all right so i i can i can uh take
inviter's privilege and ask so i don't
actually know that much about veterinary
teaching hospitals
um from putting on my my one health
curious hat
how much interplay do you is there
between wildlife
that is just ambient and contact with
animals that are then brought into
i assume not a lot of wildlife is
brought into the teaching hospital but i
but that could be a false assumption but
i do assume sort of partner animals
domestic animals and agricultural
animals are brought in how much
interaction is there in an average
veterinary hospital
among different sort of categories of
animals that might have contact with
that's a that's a good question
essentially is the veterinary teaching
hospital itself sort of a mixing bowl
um so so for our veterinary teaching
hospital at least
um the livestock animals and the sort of
companion animals
us effectively have different wings of
the hospital um and indeed
sort of even in sort of the large animal
setting
most of the things we think of as
livestock animals so sheep cows llamas
etc
and horses are actually also separate uh
the equine icu is very swanky
um for the companion animals um
they're mixed together somewhat so you
can foresee sort of a
and they're they're kenneled so you can
for example see for ca
there was a contact between some unknown
wildlife
and a dog that dog comes to the

veterinary teaching hospital and now
there's a lot of dog to dog contact
um and one of the things that has made
sort of looking at veterinary teaching
hospitals challenging is
when we think about human hospitals
there's a there's this idea of terminal
disinfection so when you leave your room
we really clean your room you know we
there's clorox and there's robots that
shoot uv lasers and there's all kinds of
great stuff
um first of all veterinary teaching
hospitals can't afford the robots
but also the the kennel is never empty
so there's never a this is just empty
we're gonna hose it down
with bleach so you don't necessarily get
that same
sort of you have this sort of continuous
fomite exposure
thing um that's one of the reasons i'm
really interested in it is because i'm
like oh that's that's that's weird
contact
i want to study that um so yeah it's
definitely possible there's not a huge
amount of
different species mixing um
mainly and also the wildlife we do get
at least at our veterinary teaching
hospital
tends to be big wildlife so that ends up
in the large animal side
when you know or we get a grizzly or
something like that
which does happen on occasion
thank you um all right are there any
other
other questions on any of the three acts
of the the talk
or things generally
all right um i'm gonna say let's please
thank eric again for a really nice
lunch and learn seminar um and if you
have any follow-up questions for him
either on the thing on these things that
he's described or in general if you're
interested in
in statistical simulation things in
epidemiology
um especially about data
okay um but thank you so much for coming
thank you all
thank you eric that was great
[Music]
excellent talk yeah so um
so alan is a pathologist
at the vet school so you might

run into him some he does a lot of
amphibian work
oh interesting yeah i'm on uh one of the
pathologists
we have a phd residency program for
pathology here at wsu and
i'm on someone's committee who's working
on
elk hoof disease which i keep calling
elf huff disease and that's not right
um but yeah she's working on that the
pathologists are fun
yeah nice of course we're always fun
excellent
all right are there specific grizzly
diseases that get
treated in large animal hospitals like
dude no
so i mean some some of it is is grizzly
necropsy
um and then uh some of it is we are the
closest veterinary teaching hospital
so occasionally if you hit a grizzly
with your car
um people will show up with essentially
a grizzly and a pickup truck
um which is awkward because
once you once a grizzly has come in
contact with humans
they can't be rewilded so you've sort of
just given us a grizzly for life um
but but we have a group but we good news
is we have a grizzly research center
um where we study things mostly about
how the cardiovascular system of
grizzlies work because
i eat an enormous meal and then take a
nap is a really bad idea if you're a
person
and apparently a swell idea if you're a
grizzly bear so they're they're trying
to figure out
why that is but yes we do on very rare
occasion get
very strange animals um but yeah for
for the most part it's still dogs and
cats and then occasionally horses but
it is one of the perks of working by the
vet school is you can just walk by and
be like is that a llama
and yes it is today we're working on
llamas
i i really love the idea of of the
involuntary gift of a lifelong grizzly
that's yeah that's way worse than an
easter puppy
a grizzly is for life not just christmas
yeah we actually see quite we see a lot
of wildlife here and

ours are not grizzlies but black bear
and um i think the ones that maybe get a
little bit more
um hard to deal with are the ones
if you're trying to prove or disprove
that
a grizzly fed off of a human yeah
or a black bear in this case um
and i'm sure that that's some of the
cases that you all see too yeah
yeah but
[Music]
interesting covid thank you
all right all right thank you all very
much
thanks again thanks so much